Technical
COMMUNICATION

Language Diversity in Technical Communication

Привет
你好
hello
안녕하세
Olá
hola
oi
नमस्ते

Society for Technical Communication

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Technical
COMMUNICATION

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Technical Communication is a peer-reviewed, quarterly journal published by the Society for Technical Communication (STC). It is aimed at an audience of technical communication practitioners and academics. The journal's goal is to contribute to the body of knowledge of the field of technical communication from a multidisciplinary perspective, with special emphasis on the combination of academic rigor and practical relevance.

Technical Communication publishes articles in five categories:

- Applied research – reports of practically relevant (empirical or analytical) research
- Applied theory – original contributions to technical communication theory
- Case history – reports on solutions to technical communication problems
- Tutorial – instructions on processes or procedures that respond to new developments, insights, laws, standards, requirements, or technologies
- Bibliography – reviews of relevant research or bibliographic essays

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Innovation and Collaboration: From Lightweight DITA to mHealth Apps

In the May 2021 *Technical Communication* article, "Hashtag #TechComm: An Overview of Members, Networks, and Themes from 2016-2019," Chris Lam made several important recommendations, including strategies to increase technical communication practitioner and academic collaborations. In discussing one such collaboration, Lam wrote, "Developed by Carlos Evia, Michael Priestley, and a committee of volunteers, lightweight DITA is an architecture that does not rely on any particular technology or language, including XML" (Evia & Priestley, 2016). To continue our conversation from the May issue and as a prelude to the excellent articles in this issue, I interviewed Michael Priestley, Lead Information Architect at IBM, and Carlos Evia, Professor of Communication, Associate Dean for Transdisciplinary Initiatives, and Chief Technology Officer in the College of Liberal Arts and Human Sciences at Virginia Tech, about their experiences with collaboration and innovation.

Miriam: Tell us about your academic-practitioner collaboration. What is Lightweight DITA and how was it developed?

Carlos: In order to define Lightweight DITA (LwDITA), we have to start with the Darwin Information Typing Architecture (DITA), which is "an XML-based architecture for authoring, producing, and delivering topic-oriented, information-typed content that can be reused and single-sourced in a variety of ways." That is actually the official definition of the DITA open standard from its technical specification. Now, whereas DITA is based on XML, which is the acronym for the extensible markup language, LwDITA incorporates flexible markup options and allows authoring content in a subset of DITA's XML elements and representations of those elements in HTML (hypertext markup language) and Markdown (a shorthand syntax for creating HTML).

One of the key features of LwDITA as an open standard in preparation is that all of its supported markup options are compatible with each other and with DITA. Therefore, members of a publications team can create content using DITA and LwDITA (in any of its markup options) and share and reuse sentences, paragraphs, and whole topics without conversion or translation.

Now, Michael can talk more about the origins of LwDITA (and DITA) because he has been with them since the beginning.

Michael: DITA was developed at IBM for our product (software and hardware) documentation needs. We developed a deliberately extensible architecture, based on modular content, collections, and inheritance, which was definitely influenced by my experiences as a writer and information architect for object-oriented developer tools. We contributed it to the Organization for the Advancement of Structured Information Standards (OASIS) in the hopes that community adoption would both protect and build on our investment. Twenty years later, we are still using DITA, and so are many, many other companies.

About a decade ago, though, there was a lot of concern about the future of DITA—its adoption curve was flattening, and people were looking at other (in some cases even older, like Markdown) technologies for authoring. So, we spent some time looking at where DITA adoption was failing—where there was a need for DITA from a capability perspective, but a failure to adopt for some other reason. There were two main reasons we ended up focused on:

1) Complexity—authors can be intimidated by the sheer number of elements, and options for their use. And while a company can create their own simplified DITA profile (and many companies have), doing so requires additional technical knowledge, and can inhibit content interchange.

2) Community investment in their existing standard-when an authoring community has already bought in to an authoring format—like Markdown or HTML authored in a web content management system—the barriers to shifting to another format are extremely high.

LwDITA became an opportunity to address both of those concerns at once: create a simplified vocabulary and architecture that could then be applied outside XML, starting with Markdown and HTML.

I shared a draft version of an HTML spec for LwDITA on Twitter, and Carlos reached out to me, and we've been partners on its development ever since.

Miriam: This year, I attended Adobe DITA World 2021, which included over 400 of the Fortune 500 companies. What types of organizations are currently using (or should be using) Lightweight DITA?

Michael: The Markdown flavor in particular is proving popular where content is authored primarily or in collaboration with developers. That's probably the area where it's taken off the most, but as Carlos says, the opportunities are wider than that, and we're seeing case studies and adoption across a wide range of use cases.

Carlos: DITA has been associated with technical content primarily because of its origins at IBM. However, the DITA standard is used across organizations for all types of content and not exclusively for technical documentation. Actually, the forthcoming 2.0 version of the DITA standard separates its base topic structure from the technical content topic

types (i.e. concept, task, and reference) that are traditionally associated with DITA. LwDITA shares that agnostic approach to content, and we have already seen preliminary implementations for marketing, procedural information, software and application programming interface (API) documentation, and many other forms of digital communication.

Miriam: The two of you wrote an article for *Technical Communication,* "Structured Authoring without XML: Evaluating Lightweight DITA for Technical Documentation," which received a 2017 STC Frank R. Smith Award for Distinguished Journal Article. What recommendations do you have for practitioners and researchers in higher education who want to collaborate on projects or research articles but aren't sure how to begin? What first steps can you recommend?

Carlos: Don't be shy. I remember going to conferences like the STC Summit and meeting people from industry. I was pretty much in groups with my academic colleagues and reaching across the aisle to talk to vendors and people in industry was a little intimidating … but I started doing that. I even had the conscious idea of meeting at least one practitioner or vendor per conference. And then I started following them on social media channels.

The beginning of my collaborations with Michael was like that. I had been following him on Twitter for years because of his DITA work, but we had not met in person. I did know, however, many of his colleagues because of

my explorations in conferences. And then one day I just emailed him and said "Hi, I looked at your Lightweight DITA idea and made a sample project. Do you want to see it and give me feedback?" and we have been working together since then.

Michael: What he said! Find people you want to collaborate with and reach out. The first part is finding those people—finding conferences with a good mix of backgrounds, or meetups—building bridges based on interest, rather than organizational category.

Miriam: How should we introduce DITA or Lightweight DITA to our students? Do you recommend stand-alone courses? If so, what kind? Undergraduate level, graduate-level, certificates? Also, what resources are available to learn or teach Lightweight DITA?

Michael: Totally going to defer to Carlos on this one.

Carlos: I have taught DITA and LwDITA in courses at the undergraduate and graduate levels in the Department of English and the School of Communication at Virginia Tech. I have seen how both undergraduate and graduate students benefit from learning concepts of topic-based authoring, content reuse, and multichannel publication. In my experience, I can say that one course is a good introduction but not enough to prepare students for careers in content operations based on DITA or LwDITA-like workflows. So, I would say that it depends on the curricular objective: if you want an introduction, then one course would work; but if you want true career preparation, then you need more than one course.

Miriam F. Williams, Editor

I think, based on conversations with colleagues in industry and academia as part of a research study that I am conducting with Rebekka Andersen, that probably our standard curricular approach to technical communication in the United States needs a shakeup. [Editor's note: Rebekka Andersen and JoAnn Hackos's article, "Practicing Technical Communicators' Experiences with and Perspectives on Academic Publishing" appears in this issue of Technical Communication.] Many existing programs are built around publication: there's the web course, the documentation course, the proposal course, the report course, etc. Contemporary approaches to technical content (and other forms of content) should emphasize audience analysis and process, but from a publication-agnostic perspective. The deliverables are built on demand from a well structured repository of topics, and DITA and LwDITA-based workflows enable that.

Regarding resources to learn and teach LwDITA, all the materials that we develop for OASIS are free. Of course, if you twist my arm, I can do a shameless promotion pitch for my book "Creating Intelligent Content with Lightweight DITA," which documents the development of this proposed standard and also gives examples for teaching about it in technical communication courses.

IN THIS ISSUE

The excellent case history, tutorial, and research articles in this issue demonstrate the importance of innovation and collaboration in technical communication. The articles discuss emerging research areas that are important for practitioners, researchers, teachers, and students. So, to introduce their excellent work, I asked the authors in this issue to answer the following questions: 1) What is new or innovative about this research? And 2) How might academics and practitioners collaborate to continue this important discussion?

In discussing their article, "Theory-to-Query: Developing a Corpus-Analysis Method Using Computer Programming, " Cana Uluak Itchuaqiyaq, Nupoor Ranade, and Rebecca Walton responded,

> This case history documents the development and use of the new theory-to-query method to transform theoretical approaches to computer code for analysis. This article also provides a strong rationale and context for the connection between citation practices and equity in academia.

> Although interdisciplinarity has become a crucial component of TC work, more than often it remains focused towards the need for interdisciplinary skills and competencies. Our article argues that humans are a major component of organizational processes, and a focus on interdisciplinary collaborations across teams can not only utilize diverse skills, but also boost conscious participation in problem solving through articulation and other communication practices in practitioner communities. The Theory-to-Query workflow demonstrates how this can be achieved in both academic and practitioner workspaces.

In discussing the importance of innovation and collaboration in "Practicing Technical Communicators' Experiences with and Perspectives on Academic Publishing," Rebekka Andersen and JoAnn Hackos wrote,

> Drawing from perspectives shared by 187 practicing technical communicators, this study describes concrete ways in which academic research in the field can reach and impact much wider audiences, particularly TC stakeholders who are well positioned to apply research results and help shape new research questions and projects. The study is the first to examine practitioner experiences with and perspectives on academic research since Beard, Williams, and Doheny-Farina (1989) conducted their survey of practitioner experiences and perspectives.

> We offer several suggestions for how academics and practitioners can continue this important discussion in our article conclusion. There, we specifically address how journals and professional organizations might better promote and increase access to published research and how authors and journals might increase the relevance, value, and accessibility of practice-oriented research for non-academic readers. We offer practitioners specific suggestions, too, such

as volunteering work sites, proposing research questions and studies needed, and serving on journal reviewer boards.

Scott Mogull, when reflecting on the role of innovation and collaboration in his article, "Developing Technical Videos: Genres (or "Templates") for Video Planning, Storyboarding, Scriptwriting, and Production" wrote,

> This article synthesizes information throughout the technical communication literature on video development, with a focus on providing an organized and cohesive guide for research-informed practice. This article provides distinction between nine categories of different types of technical videos and introduces four genres for planning and writing videos in industry. The goal of this article is to provide a resource focusing on the written genres involved in the production of videos in industry.
>
> Academics and practitioners may continue this discussion by providing additional examples and analyses of the content and style of video scripts for each of the nine different categories of technical videos. Additionally, visual communicators may further contribute to the training and practice of communication through video by analysis of the visual channel of different categories of technical video. Visual communicators may also continue this discussion

by providing further analysis and recommendations for dynamism and engagement of technical videos, which are noted challenges for technical writers new to the video medium.

In Brian C. Britt and Rebecca K. Britt's reflection on the role of innovation and collaboration in their article, "Roles of Medium and Narrative Believability in Guided Mobile Tour Navigation," they wrote,

> Our research offers a unique perspective on users' perceptions of tour narratives and the tour experience as a whole. As our study shows, even narratives that are obviously fictional, such as one led by a self-described "holographic tour guide," can have profound effects on engagement with a guided mobile tour. This research benefitted from an innovative methodological framework, including the use of a survey instrument originally developed to predict the outcomes of legal proceedings, in order to yield novel findings about tour navigation efficacy and appreciation of the tour narrative itself.
>
> Academics and practitioners would benefit from further exploring the narrative transportation that occurs during guided mobile tours. This would help them to identify pitfalls that can interrupt such transportation as well as technical communication techniques

to enrich the tour experience without worsening users' navigation. This can culminate in a set of best practices for developing guided mobile tours that utilize plausible narratives, leveraging practitioners' perspective of the state-of-the-art in the field alongside academics' observations of the effects that different media and communicative cues have on the user experience in various contexts.

When discussing innovation and collaboration in their article, "mHealth Apps and Usability: Using User-Generated Content to Explore Users' Experiences with a Civilian First Responder App," authors Candice A. Welhausen and Kristin Marie Bivens wrote,

> In terms of promoting a practitioner-academic crossover, we use two common usability methods from technical communication--open card sorting and affinity diagramming--to analyze user-generated content (i.e, review comments). Through our qualitative approach, we merged these usability methods and leveraged them to analyze user-generated content (UGC), which is new.
>
> Secondly, this methodology as well as the size of our dataset allowed us to identify detailed themes in users' experiences with the app as well as focus on the aspects of those experiences that are important to users because review comments are voluntarily contributed. As such, we propose that technical

communicators can find value in harvesting this information, which can save time and resources by (in some cases) eliminating and/or reducing the need for in-person user testing.

Further, the kinds of feedback that users' provide in review comments might not be collected from traditional usability methods because these methods tend to use a more structured approach that usually seeks to solicit specific kinds of feedback from users. Toward this end, and as we state in the conclusion (citing Getto & Labriola, 2019, p. 386), our research aims to contribute to the move in the field toward foregrounding the role of users 'as collaborators.'

Our project is a joint effort that engaged the PulsePoint foundation, our respective institutions of higher education, and we employed several research assistants, students at our institutions. As such, our multi-institutional collaboration initiated a crossover experience at the intersection in TC of practitioner and scholarly work.

By engaging in content analyses of UGC, we demonstrate how that analysis can be transformed into a tool for TC practitioners and also returned back to the community it comes from (i.e., the PulsePoint Foundation). For example, we presented this article's project at the STC 2021 Summit, and we received feedback from practitioners about how they might potentially implement the heuristic (or elements of it) into their own TC work.

Furthermore, by reaching out to Pulse Point app developers, as we state in the article, to discuss the information we were collecting about their users, we also called developers' attention to the importance of attending to audiences as developers create and modify their products. This action, too, emphasized ethical and responsible data management practices, which are a cornerstone of the field. As such, we have completed what we think is an ethical research cycle and behaved as ethical researchers.

In sum, by focusing on usability and because technical communication experts are primarily concerned with advocating for the needs of users, our project connects the interests of technical communication experts--both academics and practitioners--, app developers, and users, providing a path for forging more effective relationships among these groups.

On the Cover

ARTISTS' NOTES

I chose "cultivating language diversity in technical communication" as my guideline. My inspiration came from the words "world wide web." I wanted my illustration to embody those words and the popular understanding of the term. I included some of the most popular languages on the Internet and in spoken form. I chose eight languages because I wanted to showcase the diversity in written languages across the globe that are used to communicate through technology. In the background is an overlay of keys to a keyboard falling into the globe, giving the image a sense of movement. The lines connecting various dots on the screen from across the globe also give the image movement. The angling of the words, hopefully, give a sense that the words are being sent and traveling across the image via these connecting lines.

ABOUT THE ARTIST

William C. Sechrist is an undergraduate student at Eastern Kentucky University pursuing a B.A. in English. William is also completing a certification in Professional and Technical Writing as well as a minor in History. He is passionate about his studies and expressing his creativity whenever and wherever possible.

Theory-to-Query: Developing a Corpus-Analysis Method Using Computer Programming and Human Analysis

By Cana Uluak Itchuaqiyaq, Nupoor Ranade, and Rebecca Walton

ABSTRACT

Purpose: This case history reports on the process of developing a method to identify, extract, and clean string citation data from a corpus of articles to assist future studies on research methods, especially those relating citation metrics to diversity and inclusion efforts in technical communication.

Method: We developed a theory-to-query method that uses a theoretical framework, computer logic, and collaborative research design to create a custom computer program to extract data from a large corpus of text. This research method uses an iterative approach involving both human and computer analysis to complete the necessary tasks.

Results: Although we successfully created a custom computer program to parse citations, both human and computer analysis were needed to effectively extract data from the corpus. The allocation of labor (human vs. computer) was driven by the limitations of the data as well as by the limitations of human and computer abilities, rather than by the type of task (e.g., repetitive, requiring pattern recognition).

Conclusion: Interdisciplinary partners should use a framework to communicate effectively in their design process to better refine a project's scope, overcome unexpected limitations, and troubleshoot. Theory-to-query is a method that combines theoretical frameworks, computer logic, and collaborative research design to create custom programs that aid analysis, such as designing a program for extracting citations from a corpus of journal articles. However, even with detailed plans and clear communication, design processes require iteration and creativity as new limitations for both human and computer analysis are identified.

Keywords: Iterative design, social justice, big data, citation analysis, computer programming

Practitioner's Takeaway:

- Theory-to-query is a method that can be used for developing custom computer programs for conducting big-data research as a team.
- Iterative design processes, if backed by structured communication schemes such as a coding logic document, allow interdisciplinary teams to work together more effectively.

- Our results demonstrate that a hybrid approach using both computer and human labor for complex data extraction improves the accuracy of results, but that the assignment of tasks to either humans or computers cannot be typified.

Theory-to-Query

INTRODUCTION

A growing body of scholarship in technical and professional communication (TPC) calls for increasing our field's diversity and inclusivity (Jones, 2016; Jones, Savage, and Yu, 2014; Savage & Agboka, 2016; Walton, Moore, & Jones, 2019). Although these terms are often paired and occasionally conflated, *diversity* refers to being represented (i.e., having a seat at the table), whereas *inclusivity* refers to being welcome and valued (i.e., having a say) (Ahmed, 2012). Arguably, one of the most influential and important ways to "have a say" in academia is to publish scholarship that is widely read and cited. Thus, analyzing TPC scholarship for citation patterns offers one way of gauging inclusivity at a field-wide level: Whose work influences scholarly conversations, to what extent, and in what ways?

Citation patterns—who gets cited and how—have implications for what our field values. For example, string citations, a type of citation in which more than one reference is cited at once, may signal insufficient engagement with particular scholarship or even marginalization (Delgado, 1992). This is because string citations involve citing a publication only in a "string" alongside other work and not discussing the publication's specific arguments or contributions. As researchers committed to improving the field's diversity and inclusivity, we sought to contribute an understanding of the field's citation patterns.

Though the field of evaluative bibliometrics is quite advanced, current bibliometric methods focus primarily on citations in general and not specifically on parsing *string* citations for analysis. Citational practices in scientific and technical fields are significantly different from the humanities. Engineering fields use numbered citation styles which, as Dowdey (1992) points out, blur distinctions among individual authors and texts by using a range of numbers, such as "[5–8]," to refer to texts and discouraging direct quotations. We discovered that existing methods of citation analysis belonged to these fields and therefore, new methods would have to be developed to map the citation patterns of our field at a large-enough scope to suggest field-wide values and to analyze these patterns at a fine-enough level of detail to indicate the presence, absence, and/or type of marginalization. This case history reports our process for developing a method for parsing string citations from journal articles for future analysis. Specifically, we describe how we collected data and solved a problem that was a precondition for conducting a thorough citation pattern analysis: developing a method to identify and extract string citations from a corpus of articles (n=777) published in five major TPC journals from 2012 to 2019. This case history addresses the following research questions:

RQ1. How can we develop methods to identify and extract string citations from a large corpus of texts?

RQ2. What factors should govern the allocation of tasks to humans and computers?

In the following sections, we first contextualize our project with a literature review, followed by a methods section detailing the process for defining project parameters, generating the corpus, creating custom code to identify string citations, and testing the outputs of the custom code. We then present our results and reflect on the process of working together to develop a method to extract string citation data. Finally, we discuss potential future studies and synthesize takeaways in the conclusion section.

LITERATURE REVIEW

To contextualize this case history, we summarize three areas of literature. First, we discuss two articles by Richard Delgado that identify how citation patterns can both reflect and reinforce marginalization. Second, we overview citation analysis methods and findings to contextualize the development of our theory-to-query method. Finally, we contextualize the research questions addressed in this case history by defining big data and summarizing challenges with developing big data methodologies such as the method we developed to identify and extract string citations.

Publications as Sites of Marginalization

Our broader research study was inspired by Richard Delgado, a prominent critical race theory (CRT) scholar. Considered to be key CRT scholarship, Delgado's 1984 "Imperial Scholar" article made serious waves in his field. Delgado used manual citation analysis techniques to trace the identity factors (white/non-white, male/female) of cited authors' and citing authors' in a set of 20 articles (1984, p. 561). Delgado found that a set of 26 authors were writing the bulk of publications discussing civil rights: a group he dubbed the "inner circle." Although these authors wrote about the oppression of minorities, they themselves were

Cana Uluak Itchuaqiyaq, Nupoor Ranade, and Rebecca Walton

part of the dominant population: white men. Delgado argued that an effect of discourse written almost exclusively by white men is a perennially soft take on structures of oppression. Furthermore, Delgado found that the inner circle cited other members of the inner circle almost exclusively, even though well-qualified minority scholars had also published relevant scholarship. Delgado discussed how the overwhelming dominance of white men cited in this body of scholarship may not necessarily be an act of conscious exclusion; it might just indicate heightened interest from white male scholars. However, he claims, this domination—especially in scholarship discussing marginalization and oppression of minorities and especially when minority scholars had published relevant, but uncited, work—is revealing. Citation is a strategic choice; who is cited and how they are cited are choices reflecting the priorities and values of the author.

Nearly 10 years later, Delgado (1992) conducted a follow-up citational study analyzing publication and citation practices in both CRT and radical feminist thought to see if those practices had changed. He used manual methods to investigate the citation practices of the 26 inner-circle authors to determine if they cited "minority" scholars (for Delgado's study, this meant non-white scholars and/or female scholars) in their post-"Imperial Scholar" publications (1992, pp. 1350-52). They had. He then analyzed the citation contexts in terms of purpose and polarity to determine *why* and *how* minority scholars were cited by the inner circle and the attitude conveyed by citing authors (positive, negative, etc.) towards the cited works. Delgado found that although minority scholars were getting published and cited more, often these authors were cited solely within string citations and notes. Delgado noted that string citations could signal a lack of engagement with the cited work and, ultimately, a lack of inclusivity. He discusses how relegating authors to citation instances only within string citations allows the citing author to demonstrate familiarity "with the new work while avoiding fully accounting for it in his analysis. The approach also conveys the message that minority or feminist writing is deservedly obscure, and thus only worthy of passive mention" (p. 1359). This finding indicates that, although citation patterns may reflect greater diversity, practices such as string citations may signal a lack of inclusion by declining to legitimize

knowledge produced by traditionally underrepresented scholars.

As Delgado demonstrates in his studies, citation analysis is an effective way to investigate the inclusion of multiply marginalized and underrepresented (MMU) scholars in a field's publications. In addition, Lawani and Bayer (1983) point to the many reasons that citation analysis acts as an effective method to measure scholar success:

Despite the ambiguities of citation practices, the difficulties of ascertaining why a paper is cited or not cited and the potential malpractices in citing, considerable evidence has been accumulated to suggest that citations do indeed provide an objective measure of what is variously termed 'productivity', 'significance', 'quality', 'utility', 'influence', 'effectiveness', or 'impact' of scientists and their scholarly products. (p. 61)

Because citation analysis is an effective way to measure scholar success, it is also an effective way to gauge potential marginalization.

Citation Analysis Methods to Uncover Marginalization

Campbell (2000) has argued that very few publications document the status of research methods specializing in business and technical communication. She agrees that the lack of documentation on research methods has led to incomplete, outdated knowledge of research methods which has promoted the reinvention of the wheel rather than building on prior knowledge gained through business and technical communication research. To avoid reinventing the wheel, we studied the literature on citation analysis methods in our field before developing the method described in this case study (Campbell, 2000). We came across a few works specifically relevant to our study, which are described in this section. Delgado's 1984 and 1992 studies were conducted manually. Manual methods allowed for detailed, targeted analysis of relatively small sample sizes (n=20 articles [1984, p. 561] and n=26 authors' manuscripts citing "insurgent" authors [1992, pp. 1350-52]). Delgado's citation research contributes to a larger field of study analyzing citation and its impacts on academia and law that began decades before his initial analysis. An important change in related fields like evaluative bibliometrics and scientometrics is the increasing use of computer processing in citation analysis techniques. Contemporary citation analysis

Theory-to-Query

studies often use computer techniques to analyze large sample sizes, some in excess of 5 million articles over two large databases (Tahamtan & Bornmann, 2019), that would be impossible to analyze manually.

While citation analysis studies engage a broad range of topics, scholars have used these computational techniques to investigate issues explicitly and implicitly related to potential marginalization. Hou, Li, and Niu (2011) argue that it is through counting in-text citation instances within the body of a manuscript, rather than focusing on the references list, that determinations of a cited work's influence are most "fairly" made. They assert that analyzing reference lists alone does not provide the context necessary for understanding *how* a cited work is used: "Some references are indispensable; they directly stimulate hypotheses or provide essential methods. By contrast, some other references are cited just for background information or are incidentally mentioned" (p. 724). Zhu, Turney, Lemire, and Vellino (2015) attempted to determine how the relative influence of a cited work correlated with the number of citation instances of such work within an article. They assert that "citation frequency is a measure of this influence, but a better measure would take into account how a researcher is cited, rather than giving all citations equal weight" (p. 409). Though they do not frame their research in terms of marginalization in the same way as Delgado (1984, 1992), Hou, et al. (2011) and Zhu et al.'s (2015) findings can inform the work of scholars using counting techniques to uncover issues of marginalization. Chakravartty, Kuo, Grubbs, and McIlwain (2018) critique citation practices in communication studies and the lack of diversity of authors who are cited or whose work is deemed influential: "the existing representational disparity [of minority scholars' authorship of publications] contributes to the citation disparity: White authors will always have a greater opportunity to be cited because White scholars have a greater number of publications" (p. 260). Chang (2009) makes a similar critique, echoing that of Delgado (1984) and laying out the importance of citation patterns:

The voices of minority scholars will not be heard if we do not have the opportunity to write. In order to write, we must have a place from which to write. If we are not cited, then we are less likely to advance in the profession. This is amplified if the leaders in our field do not cite us or engage our work. If we are denied tenure,

then we are very unlikely to produce legal scholarship. And even if tenure is achieved, lack of citation by the leaders in our field can limit the possibility for advancement and influence, as it is quite probable that our influence is connected to the reputation of our institution. In short, being cited as well as who cites us matters. (p. 33)

Citation analysis studies have an importance beyond understanding the mechanisms of citation practices. They provide a useful metric to understand more nebulous concepts, such as the marginalization of minority scholars.

In general, citation analysis studies use databases of bibliometric data, specifically formatted articles, and existing citation analysis programs to conduct research on large corpora of publications. For example, Tahamtan and Bornmann (2019) surveyed citation analysis studies investigating citation behavior between 2006 and 2018 and found that large-scale studies have been accommodated by technological developments, such as "the existence of machine-readable formats of publications (XML tags)" (p. 8), "journals and publishers have made scientific papers available and downloadable in XML-formatted full texts" (p. 9), and "algorithms and other services that can be used in citation context studies" (p. 10).

While XML-based citation studies' methods provide respite from the "problematic, tedious and time consuming" (Tahamtan & Bornmann, 2019, p. 8) process of computational analysis of PDF-to-TXT formatted publication samples, not all journals or publishers provide access to XML documents. Pride and Knoth (2017) state that "unless a paper is available in a structure format, such as an XML, there is a requirement for converting the original PDF file into full text prior to analysis" (p. 3). Further, available citation analysis tools center on parsing citation instances in general rather than parsing individual string citations for analysis.

Such tools, therefore, would not facilitate the analysis we wanted to conduct: focusing on string citations in research articles published in five major TPC journals. These publications are available from their respective publishers behind a paywall and only in PDF format. Such factors required that we develop a method to both read and parse string citations from our sample of journal articles. Though this process was, as Tahamtan and Bornmann describe, "problematic,

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tedious and time consuming," using a PDF-to-TXT approach that involved creating a program in Python best fit the constraints of our sample, our needs, and our programming environment. In this case history, we present the development of this method, which can be useful for overcoming the challenge of analyzing big data sets that are specific to TPC.

Big Data Methods in Corpora Analysis

A number of factors enable the development of methods such as the one reported in this case history. For example, the availability and processability of full-text archives like journals and newspapers, as well as recent developments in computational technologies, enable researchers in almost all disciplines to perform corpus analysis on large datasets (Wiedemann, 2013). However, analysis mechanisms for large data sets have been looked upon suspiciously in the humanities due to the "context-dependent interpretation and the situated-ness of researchers and their aims" (Schöch, 2013). Researchers have often struggled to differentiate between big data and large data in humanities fields. Manovich (2011) observes that large corpora are only one criterion, whereas the process used for analyzing those corpora is more crucial. Big data in the information sciences has to do with the volume, variety, and velocity of information. In the humanities, especially where corpora comprise journal articles from one field, one can argue that the variety is missing. boyd and Crawford (2012) get closest to defining big data for such studies as a cultural, technological, and scholarly phenomenon that rests on the interplay of *technology* (maximizing computation power and algorithmic accuracy to gather, analyze, link, and compare large data sets); *analysis* (identifying patterns to enable economic, social, technical, and legal claims); and *mythology* (considering relationships among truth, objectivity, and accuracy). This three-faceted definition informed our approach to developing the theory-to-query method, as all three considerations guided our work.

Finding an appropriate method to analyze big data can be challenging. Manual content-analysis methods are not designed for big data sets. If used, they have been found to produce erroneous results. And conducting manual analysis of only a sampling of a large corpus can have large margins of error. An alternative approach is using algorithms and computational analysis methods like APIs and statistical data-modeling tools. But these tools are unable to understand "latent meanings or the subtleties of human language" (Lewis, Zamith, & Hermida, 2013). Other computerized approaches to content analysis also may yield satisfactory results for only surface-level analyses, sacrificing more nuanced meanings present in the analyzed texts (Conway, 2006; Linderman, 2001; Nacos et al., 1991).

These challenges have encouraged humanities scholars to find innovative solutions to address problems of analyzing large corpora. Lewis et al. (2013) argue that often, the best approach may be a hybrid that blends human and computational methods of content analysis. Hybrid methods assign tedious, repetitive tasks to computational algorithms, leaving tasks of contextual inquiry to human coders. In this way, computational methods enhance but do not replace the work of human coders, enabling researchers to work with big data while also remaining sensitive to contextual nuance. Such a division of labor sounds ideal, but as we discovered in developing the hybrid method presented in this case history, it may not be so straightforward.

METHOD

Working together to develop and use our theory-to-query method required an organized, iterative approach discussed in detail here. A theory-to-query method combines a theoretical framework (such as Delgado's 1992 critique of marginalizing string citation practices), computer logic, and collaborative research design to create a custom computer program to augment human analysis. Such methods enable researchers to apply theoretical lenses to big data research by identifying and extracting specific data from large corpora. In our case, we created a computer program to parse string citations. As Figure 1 demonstrates, theory-to-query has four major steps: 1) defining project parameters, 2) generating the initial data, 3) creating a custom computer program, and 4) testing computer program outputs. Because this is an iterative process where new information or limitations may spark the need to revisit parts of the process, clear communication and iterative scoping are crucial.

Defining Project Parameters

For communication purposes, it was important to create a coding logic document (refer to Appendix A) to clearly define our project goals. This realization

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came early on as all authors tried to communicate about the theoretical implications of string citations, as well as the nuances of identifying and extracting in-text citations using a computer program. We quickly became confused about what exactly we were asking the computer to do. To further complicate these exchanges, all three of us have different levels of experience with computer programming. These varying levels of expertise required that we find efficient, effective, and precise ways to communicate together about our project.

For example, people who are not computer programmers who use a theory-to-query approach to develop a custom computer program should first understand that computer programming tends to operate on basic rules and true/false statements. Therefore, when conveying to a programmer what

the program should do, a good strategy is to describe each process and subprocess in terms of if/then/else statements. For example, we were searching for string citations. In APA-styled manuscripts, string citations appear only within a set of parentheses with each reference separated by a semicolon: e.g., (Aarons, 2012; Black Horse, 2017). So, *if* a semicolon occurs within a parenthesis, *then* the program should extract the parentheses and all text contained therein *else* the program should ignore the text and continue onto the next parenthesis. Also useful was developing a set of terms—a project-specific glossary—to precisely refer to concepts at the core of our project (refer to Table 1): e.g., APA-style String Citation, Chicago-style String Citation, PubCite, and StringPub.

Developing a glossary (Table 1) enabled us to discuss and define the precise nature of the data
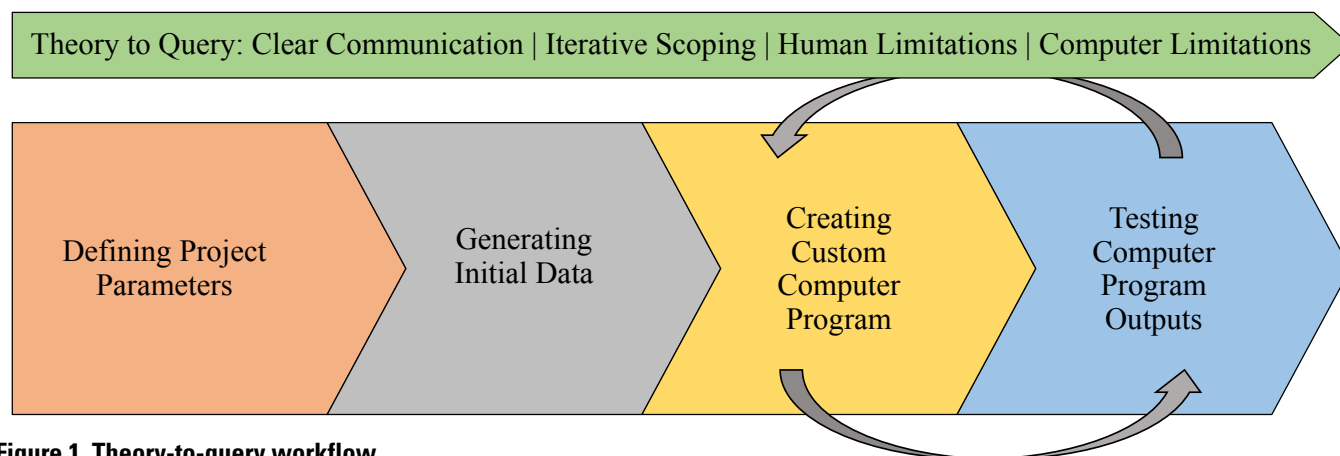
Figure 1. Theory-to-query workflow

Table 1. Project-specific glossary

Term	Definition	Example
APA-Style String Citation	An in-text reference that lists a series of two or more pieces of relevant scholarship supporting an argument. This format uses author last names and year, and lists authors in alphabetical order.	The fictitious sentence "Dogs bark at trains (Aarons, 2012; Black Horse, 2017; Change, Liu, & Billingsly, 2013; Hassan, 2015)" uses an APA-style string citation.
Chicago-Style String Citation	An in-text reference that lists a series of two or more pieces of relevant scholarship supporting an argument using a numbered list. Each number represents a particular reference, and references are listed in the order of citation within the article.	The fictitious sentences "Dogs bark at trains [1]-[4], [7];" and, "Dogs bark at trains [1-4, 7]" are Chicago-style string citations. The first example reflects IEEE's formatting, and the second example reflects JTWC's formatting.
PubCite	Any publication cited in an article within the corpus.	If one counted all the references in the reference section of an article and found that there were 45 references, the article would have 45 PubCites.
StringPub	A PubCite that occurs only as part of a string citation in any given article in the corpus.	The fictitious reference "Aarons (2012)" might occur as an in-text citation in a given article 10 different times, but if all of those citations are within strings, then Aarons (2012) is considered a StringPub.

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embedded in our corpora, and creating a coding logic document enabled us to break down our major goals task by task. Identifying each necessary task was an iterative process that required revisiting the project scope and updating the coding logic document as limitations arose. For example, initially we assumed that the computer program would be able to parse individual PubCites in the references list (i.e., distinguish between each reference listed) in order to complete a series of tasks. However, because the TXT files comprising our corpora had been converted from PDF files of journal articles (which were the only available electronic format for download), much like Tahamtan and Bornmann (2019) and Pride and Knoth (2017) lament, the formatting of the TXT files created problems with parceling. For example, sometimes the file-conversion process not only introduced extra paragraph breaks within a single reference, but sometimes references were erroneously interlaced, with lines appearing out of order (refer to Figure 2). Because identifying and correcting all such problems would be enormously labor intensive, we had to reconsider all of the tasks detailed in our coding logic that required

parceling information from the reference lists and come up with a new plan.

Generating Initial Data

After we had detailed the project parameters in our coding logic document, we needed to generate the initial data for our study, which consisted of a corpus of TPC journal articles. One of the first decisions was when to start: in what publication year should the corpus of TPC articles begin? Samantha Blackmon called for inclusion over 15 years ago at the CPTSC conference asking, "How do we recruit and retain minorities in our departments when there are no other minorities around?" (2004, p. 1). For years, this call went almost entirely unacknowledged in the field's scholarship until the widely acclaimed *Journal of Business and Technical Communication* special issue by Williams and Pimentel (2012) on race and ethnicity in TPC sparked more scholarship on inclusionary practices in TPC. Based on the publication date of Williams and Pimentel's milestone issue, we chose 2012 as our corpus's starting point. Our corpus consists of all articles (n=777) published between January 2012 through December 2019 from five

Figure 2. Image of reference section demonstrating extra paragraph breaks and ordering issues

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leading TPC journals: *Technical Communication* (TC, 140 articles); *Technical Communication Quarterly* (TCQ, 166 articles); *Journal of Technical Writing and Communication* (JTWC, 158 articles); *Journal of Business and Technical Communication* (JBTC, 130 articles); and, *IEEE Transactions on Professional Communication* (IEEE, 183 articles). Each article was manually downloaded as a PDF file and then batch-converted to a TXT file. Our file-naming convention for each article indicated the year, journal name, volume and issue number, and first author last name: e.g., 2012_IEEE_v55i1_Fuller.txt.

In this case history, we focus solely on how we solved the problem of identifying and extracting string citations from a large, diversely formatted corpus. Because string citations are formatted differently in Chicago-style versus APA-style articles, we divided the initial corpus into two sub-corpora: APA-style articles (n=531) and Chicago-style articles (n=246). The Chicago-style sub-corpus contained IEEE articles and pre-2015[1] JTWC articles (n=63). The APA-style sub-corpus contained JBTC, TC, TCQ, and post-2015 JTWC articles (n=95).[1]

Creating the Custom Computer Program

We started this project using a theoretical framework (based on Delgado, 1992) to inform an initial set of research questions and then used a reflexive, iterative approach to develop a method to parse data in service of those research questions. Reflexive iteration involves visiting and revisiting data and connecting them with emerging insights, progressively leading to refined focus and understandings (Srivastava & Hopwood, 2009). Thus, the iteration in this approach to data parsing is not a repetitive mechanical task but instead a reflexive process that refines project scope and research questions (Thomas, 2006). This section describes in detail how we engaged in this reflexive, iterative process responding to both data insights and limitations of computational tools.

Text-processing tasks can be automated with either custom-built programs or readily available programs. We tested several computer applications for their capabilities to analyze the corpora, namely AntConc (Anthony, 2019), LancsBox (Brezina, Timperley, & McEnery, 2018), and Regexr (Skinner, 2020). However,

each had challenges preventing their use. Initially, our goal was to develop a computer program that could identify which PubCites were StringPubs (i.e., to determine which references were cited *only* within string citations). We found that using existing applications would require individually feeding every PubCite in every article in the corpus (more than 11,000 PubCites in the 777 articles) into the computer program and manually analyzing the results. Such a process would have been impossible with such a large corpus.

We brainstormed to select an appropriate application and analytical approach, with Ranade taking the lead due to their background in computer engineering and automated data analysis. In researching the use of programming languages for corpus analysis in social sciences, we found that commercial (e.g., SAS, MATLAB) and open-source languages (e.g., R and Python) have been used to analyze data or develop applications that analyze data (McKinney, 2010). Because they can be used in conjunction with other software and have an ecosystem of ready-to-use libraries (Pedregosa et. al., 2011), languages like Python have become popular data exploratory tools in both industry and academic settings. Ranade selected Python for this project and wrote a computer program (code) to analyze the corpus. Before the corpus could be fed into the program, the corpus had to be manually pre-processed to format the articles comprising the corpus and to generate the two sub-corpora differentiated by citation style.

Ranade used Anaconda for ease of writing, editing, and demonstrating the Python code. Anaconda is an integrated development environment (IDE) which helps visualize the input and output in the same application. Visualizations supported our research team in communicating effectively. For example, the structure of the program, conditional implementations for each journal type, as well as specific operations and their correlated output can be easily demonstrated and discussed using the windows in Anaconda's layout (Figure 3).

Python has several libraries to support data analysis, and it permits the use of regular expressions to parse textual data. Regular expressions, or regexes, can be used to search files for particular patterns. We used regexes to capture and document string citations in

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1   JTWC changed from Chicago-style formatting to APA-style formatting in Volume 45, Issue 2 (Spring, 2015). Volume 45, Issue 1 was formatted in Chicago style.

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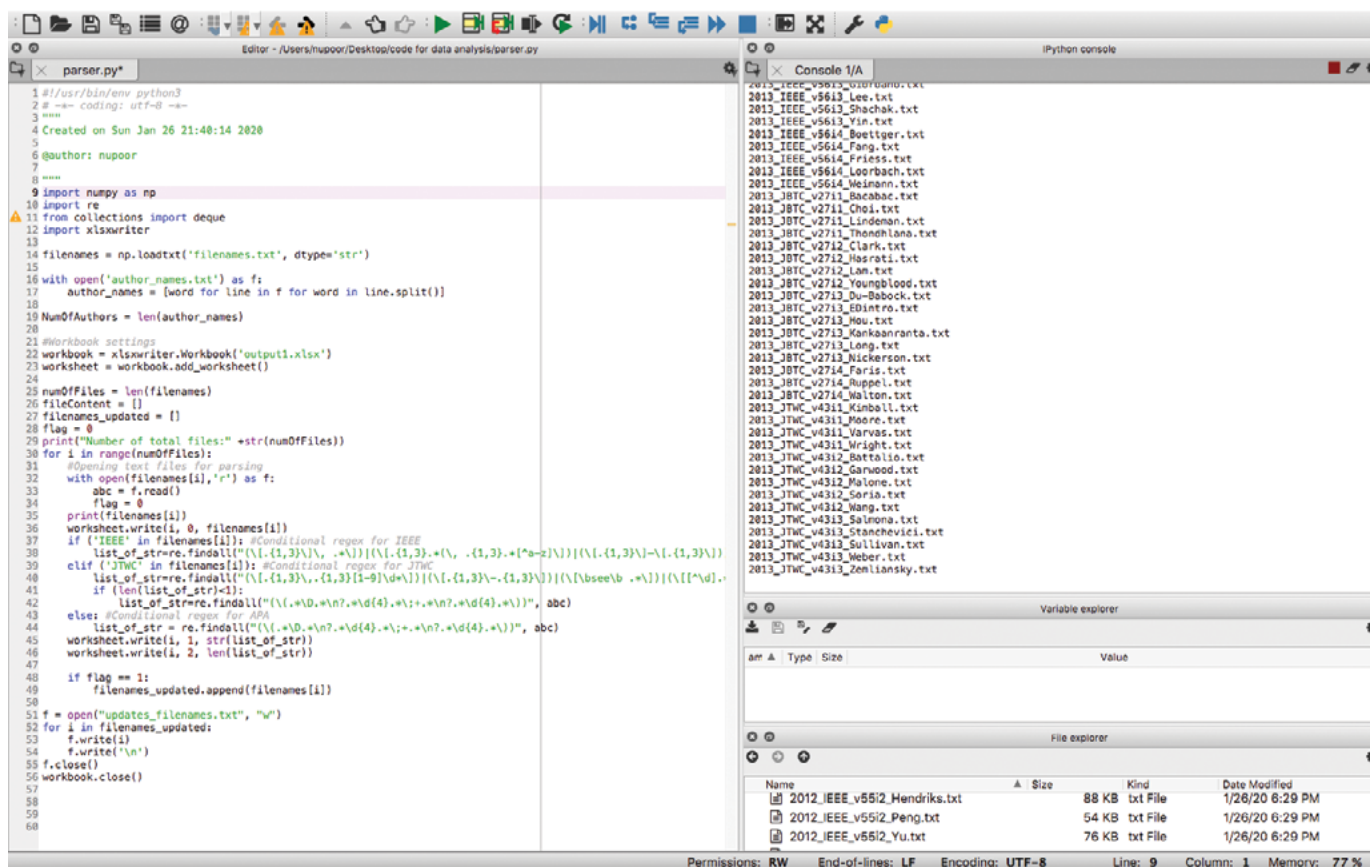
Figure 3. The split screen on the Anaconda IDE helps visualize the input and output in the same application while communicating with other researchers

both sub-corpora, but variations in citational formats required multiple regexes to be written to account for variances in citation formatting. Writing a regex is complex because regexes are highly susceptible to error. Although Python permits embedding regexes into the computer program, errors in regex formations cannot be identified through the IDE. Ranade used Regex101 to support more robust regex creation and to allow visual debugging (Ranade, 2020). We saved outputs from the code in a spreadsheet and engaged in multiple iterations of testing and code refinement to determine whether outputs were accurate.

Testing the Computer Program Outputs

While Ranade was responsible for programming, Itchuaqiyaq ensured that the results were correct and scalable to include the entire corpus. Through multiple iterations, we were able to parse the entire corpus (n=777) and get accurate results. That is, the program outputted a complete set of string citations extracted from the corpus of 777 articles, along with other information like the number of string citations in each article.

Testing was done in multiple phases. The first phase of testing found errors in file handling by the computer code and in the regexes used to identify string citations. File handling is complex. Errors can occur in converting PDF files to TXT files due to the layout, vector handling, fonts, visualizations, hyperlinks, or other variations in file formatting. We used automated batch-conversion applications to convert PDF files to TXT files. After encountering multiple errors converting particular PDF files using one such application (AntFileConverter), we used a different application (PDF to Text) to successfully convert them to TXT files. After the files were successfully converted, we discovered that the initial regex constructed to identify string citations contained errors due to the variations in citational styles used by different journals. A single regex could not be used to analyze the entire

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corpus. We ended up creating three regexes to account for formatting variations and enable us to analyze the entire corpus.

The second phase of testing revealed further problems arising from regex limitations. Capable of parsing through only uniform data and finding similar patterns, regexes are created using generic patterns of the expected result. For example, if the character sequence 'dd' (used to denote two digits) is used, the program will search for only two-digit numbers. If a year is represented by 4 digits, such as 1990, it will be omitted by the parser. Therefore, to use regexes, data must be formatted consistently throughout the corpus. To identify variations that diverged from the consistent patterns identifiable by regexes, we conducted ad-hoc testing. Ad-hoc testing is a type of software testing that is performed without using test cases, plans, documentation, or systems. Usually performed by experts who developed the method, ad-hoc testing helps in identifying important defects.

For example, we suspected a potential mismatch between the patterns sought by regexes and the format of string citations in a subset of articles because the code outputs for these articles showed unusually low numbers of string citations. Itchuaqiyaq manually

analyzed the articles with suspiciously low string citation counts and confirmed that the code outputs were inaccurate. Although ad-hoc testing is useful for detecting relatively large problems (e.g., problems affecting several articles in the corpus), it is less useful for identifying problems affecting a very small portion of the corpus (e.g., problems affecting only a few in-text citations in the entire corpus). To identify smaller problems, we wrote test cases and conducted iterative testing. Iterative coding and testing enabled us to develop improved regexes which resolved the inaccurate outputs. For example, we found a sizable set of JTWC articles in which the custom code identified no string citations at all. Upon manual review, we discovered that JTWC had switched citation formats from Chicago to APA, explaining why the Chicago-specific regexes failed to recognize APA-specific string citation patterns. We moved these articles into the APA sub-corpora, retested, and confirmed accurate results.

Refining the Results

We identified and extracted string citations from the two sub-corpora separately because the citation formatting differed so significantly. Chicago style's number-based citation format allowed for a hybrid

Table 2. Sample entry from string citation data spreadsheet

A: Filename	B: Total # of PubCites (references)	C: All Strings (from program)	D: # Strings (from program)	E: # Actual Strings	F: Expanded PubCites in Strings	G: Cleaned PubCites for StringPub Search (spreadsheet formula)	H: # Unique PubCites in Strings (spreadsheet formula)	I: # of StringPubs	J-…: Full Citations of StringPubs
2012_IEEE_v55i1_Fuller.txt	75	[('', '[1]–[3]', '', '[1]–[3]'), ('[4], [5]', '', '', ''), ('', '[6] and Helquist, Burgoon, and Wiers [7]', ', and Wiers [7]', ''), ('', '[12]–[17]', '', '[12]–[17]'), ('', '[15]–[17], [19]. Biros and colleagues [15]', ', [19]. Biros and colleagues [15]', ''), ('', '[22]–[24]', '', '[22]–[24]'), ('', '[25]–[27]', '', '[25]–[27]'), ('[16], [17], [19]', '', '', ''), ('', '[28]–[30]', '', '[28]–[30]'), ('', '[31]–[33]', '', '[31]–[33]'), ('[41], [42]', '', '', ''), ('[2], [3], [17]', '', '', ''), ('[12], [43]', '', '', ''), ('[14], [17], [33], [44]–[46]', '', '', ''), ('[16], [17]', '', '', ''), ('[12], [17]', '', '', ''), ('', '[28]–[30], [48]–[50]', ', [48]–[50]', ''), ('[58], [59]', '', '', ''), ('[15], [24]', '', '', ''), ('[15], [61]', '', '', ''), ('[19], [62], [63]', '', '', ''), ('[24], [68]', '', '', ''), ('[3], [40]', '', '', ''), ('[15], [24]', '', '', ''), ('[16], [64], [71]', '', '', '')]	25	24	1,2,3,1,2,3,4,5,12,13,14,15,16,17,19,22,23,24,25,26,27,16,17,19,28,29,30,31,32,33,41,42,2,3,17,12,43,14,17,33,44,45,46,16,17,12,17,28,29,30,48,49,50,58,59,15,24,15,61,19,62,63,24,68,3,40,15,24,16,64,71	1, 12, 13, 14, 15, 16, 17, 19, 2, 22, 23, 24, 25, 26, 27, 28, 29, 3, 30, 31, 32, 33, 4, 40, 41, 42, 43, 44, 45, 46, 48, 49, 5, 50, 58, 59, 61, 62, 63, 64, 68, 71	42	30	Copy & paste each StringPub reference in subsequent cells

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human and computational data-refinement process, which we describe in this section. (The complexities of APA formatting required the development of a different data-refinement approach, which we will address in a future phase of this project.) Though we extracted raw data (i.e., string citations) from both sub-corpora using our custom computer program, we developed a data-refinement process for the Chicago-style sub-corpus first because its numerically based citation format made the data-refinement process much easier. The computer-extracted data from the Chicago-style sub-corpus was organized into a single spreadsheet. Table 2 presents an example of the refined, extracted data with outputs from human (manual) tasks in white cells and computer (automated) tasks in gray cells.

The raw string citation data extracted by the computer needed to be further refined for use in analysis. We conducted this refinement manually rather than computationally because of the vast amount of coding that would be required to categorize and refine this raw data. We hired a research assistant to analyze the program's output (refer to Column C and D in Table 2). Each row in the spreadsheet contains data for a single article in the Chicago-style sub-corpora. Column C contains all the string citations extracted by the custom code, with each individual string citation placed within its own set of parentheses. Column D contains a count of the string citations extracted by the program. Our research assistant read and evaluated the data in each set of parentheses in Column C and compared them against the examples of string citation formatting listed in the StringPub Identification Protocol (Appendix B) to identify errors (i.e., article text that was inaccurately extracted as a string citation). She indicated extraction errors by bolding the corresponding text in Column C. She then subtracted the errors from the total in Column D and entered the corrected total in Column E.

The research assistant then expanded all confirmed-accurate string citations from the computer program's output: for example, expanding an entry like "('', '[1]–[3]', '', '[1]–[5]')" in Column C into "1,2,3,1,2,3,4,5" in Column F. Column G uses a spreadsheet formula to convert the disorganized and repetitive entry in Column F ("1,2,3,1,2,3,4,5,") into a numerically ordered form that excludes replicates: 1, 2, 3, 4, 5. Column H uses a spreadsheet formula to count the number of PubCites listed in Column G. This count

(Column H) represents the number of PubCites that are cited in a string citation in a particular journal article at least once.

To determine if a PubCite is a StringPub (i.e., if a PubCite was cited *only* as part of string citations), the research assistant used the data in Column G (Table 2) to manually check how each of the listed PubCites was cited within the journal article. This involved opening the article's file and searching for each citation (string citation or otherwise) in the article's text for every PubCite listed in Column G. The research assistant used the StringPub Identification Protocol we developed (Appendix B) to evaluate each PubCite in Column G and determine if it was a StringPub. She entered the full citation for each StringPub in the article into its own cell (Column J - end). A spreadsheet formula was used to count the number of citations pasted into the spreadsheet (Column I). While she had the article file open, the research assistant also checked the reference list (which was numbered) and entered the total number of PubCites in the article (Column B). Comparing Column I to Column B enables us to calculate the proportion of publications that are cited only in string citations compared to all cited publications for each article in the Chicago-style sub-corpus.

RESULTS

The computer program identified 24 articles within the Chicago-style sub-corpus as lacking string citations, winnowing the sub-corpus from 246 articles to 222 articles. To ensure that the computer program produced accurate results, we manually reviewed all 24 articles. We found that 11 of these articles were formatted in APA style, so we moved them to the APA-style sub-corpus. The other 13 articles were confirmed to contain no string citations; the custom code was proven accurate. The final results were as follows:

- Size of original corpus = 777 articles
- Size of Chicago-style sub-corpus (before catching the 11 APA-style articles) = 246 articles
- Size of Chicago-style sub-corpus (after removing the 11 APA-style articles) = 235 articles
- Number of articles with 1+ StringPubs in Chicago-style sub-corpus = 197
- Number of articles with 1+ string citations but no StringPubs = 25

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- Number of articles with zero string citations in Chicago-style sub-corpus = 13
- Number of PubCites in Chicago-style sub-corpus = 11,528
- Number of string citations in Chicago-style sub-corpus = 2,279
- Number of StringPubs in Chicago-style sub-corpus = 3,065

Figure 4 presents the relationship between the number of string citations and the number of PubCites in the Chicago-style sub-corpus. This figure also indicates the amount of inaccuracy in the computer-generated output versus the manually refined data.

These results were achieved with interleaving phases of manual and computational data extraction and cleaning. Although the computer program was able to parse through a large number of files and find string citations that matched regexes, sometimes those regexes inaccurately identified text as a string citation if it matched the generic pattern, even if that text was not a string citation. Our research assistant bolded those

erroneous strings (Column C, Table 2) and excluded them manually cleaning the data. The inaccuracies of the custom code were eliminated through manual intervention, which required only about 6 hours to complete for the entire Chicago-style sub-corpus. To conduct the entire data-extraction process manually would have been prohibitively and enormously labor intensive. These results demonstrate that our theory-to-query method is pertinent in developing programs to extract complex information from big data sets, in this case, string citations from journal articles. Our experience with this project suggests that for big data analysis work or qualitative research for big data sets, it is important to use a hybrid approach that involves computer and human labor for the best accuracy. Our final results that combine both—initial computer outputs and human outputs (that refined and extended the computer outputs)—can be used in subsequent iterations of our program to test accuracy of extracting string citations. The computer program can be
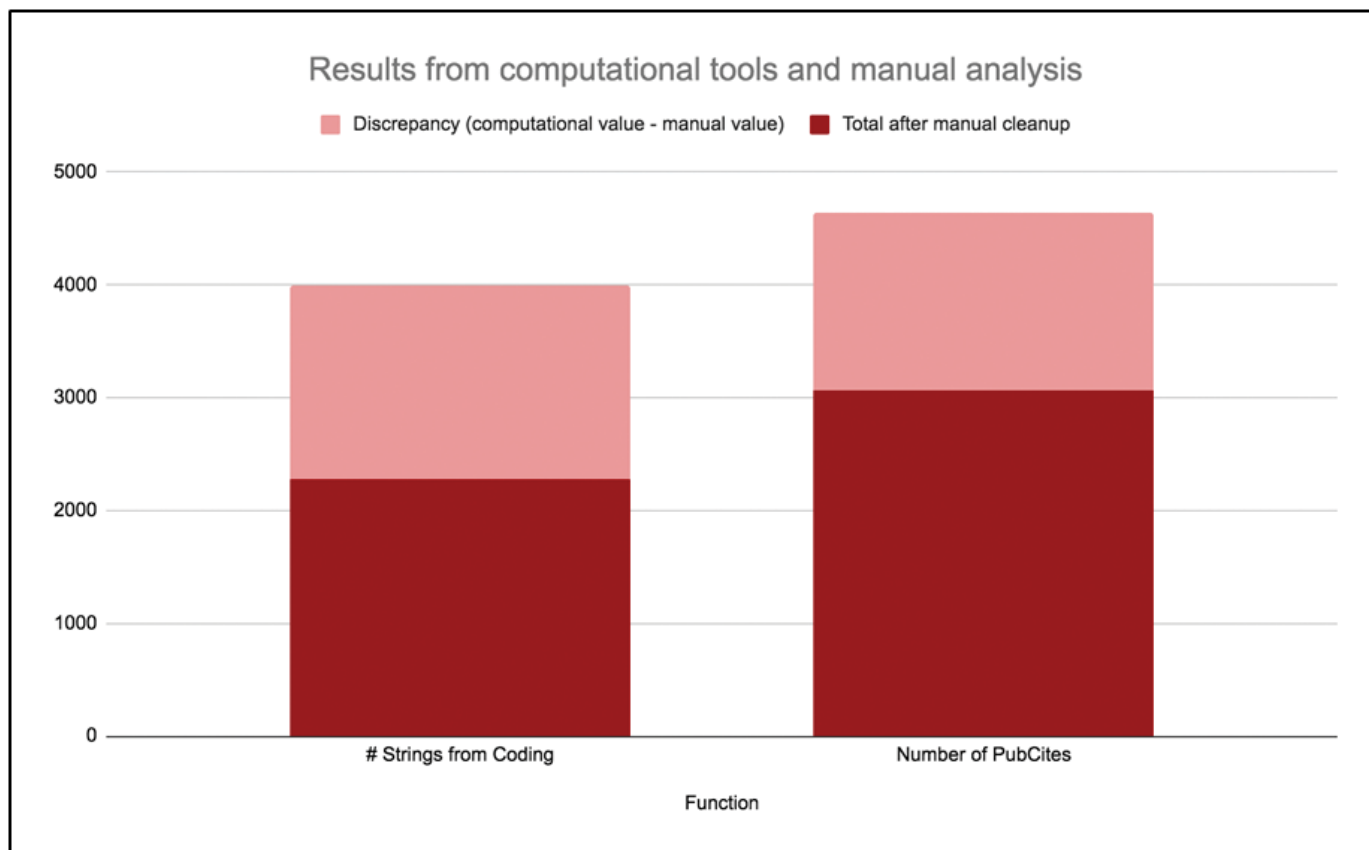
Figure 4. Amount of discrepancy resulting from the use of only computational tools. The final accurate output was generated by manual refinement

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customized further for extraction of other data (such as StringPubs) on big data sets.

DISCUSSION

RQ1. Developing Methods to Identify and Extract String Citations from a Large Corpus of Texts

There are established methods of analyzing citations (in evaluative bibliometrics, scientometrics, etc.), but there are not yet computerized methods established to distinguish between types of in-text citation (e.g., identifying only StringPubs). So, in addressing our first research question, we not only developed a theory-to-query method to develop a program that could identify and extract string citations from a large corpus of texts but also identified some lessons learned that may be applicable to many big-data projects. TPC research has demonstrated that our field cares about increasing inclusivity of multiply marginalized and underrepresented scholars (Jones, 2016; Jones, Savage, & Yu, 2014; Savage & Agboka, 2016; Walton, Moore, & Jones, 2019); citational analysis is one effective method of gauging and understanding inclusivity in academic fields (Chakravartty, Kuo, Grubbs, & McIlwain, 2018; Chang, 2009). However, to our knowledge, there are no citational analysis studies published in TPC focusing on inclusivity. In designing and conducting such a study, our team identified three major challenges to citation analysis for understanding inclusivity in our field:

It is significantly more complex to analyze specific methods of in-text citation, such as string citation (per Delgado, 1992), than to analyze citations more broadly.

Python is a suitable programming language for developing programs to parse string citations, but developing custom programs in this language requires a prohibitively high level of coding skill for many in TPC.

Most TPC journals are not open source and make articles available for download only behind a paywall and only in PDF formatting. This prevents data (that is, the field's scholarship) from being available via the XML-formatted databases used in many existing citation analysis methods and tools.

Those who wish to conduct such analyses (i.e., to investigate fieldwide inclusivity through citation analysis) will find, we hope, valuable information in the description of our method, the program we developed

(Ranade, 2020), and our lessons learned in developing the program through custom code. These lessons learned include the importance of developing shared language and iteratively scoping the project. Each lesson is discussed in detail below.

Clear communication: Developing shared language

In creating big-data methods that require custom computer code rather than simply using existing applications, it is important to establish and maintain clear communication, especially between researchers with different areas of expertise. Some keys to clear communication in this project are applicable to almost any collaborative research: e.g., regular team meetings in which every team member is present even if a particular meeting's agenda is relevant to only a subset of the team members' tasks. But other keys to clear communication are, we suspect, particularly relevant to big-data projects: e.g., developing a project-specific glossary that defines key terms relevant to both our process and our outcomes. Referring to such shared documentation while communicating in our team meetings saved time and supported us in pursuing shared goals.

For example, Itchuaqiyaq came to this project with a deep understanding of string citations: what they were, why they might matter, and how they differed in format from other citations. This expertise allowed her to easily distinguish the narrower category of "StringPub" (a publication cited only in string citations) from "PubCites" at large (any publication cited in any article within the corpus). But to convey that project-relevant expertise meaningfully to the other researchers, we needed the terms "PubCite" and "StringPub." Without this shared language, we found ourselves spending much of our research team meetings clarifying what we meant when discussing key aspects of the project—to include such central concerns as our research questions and specific desired outputs of the custom code. In other words, to be able to break down our major goals into specific tasks that could be coded, tested, and refined, we first needed the language to describe those tasks.

Similarly, Ranade brought to the project extensive expertise in computer programming. This expertise provided insight into which tasks might be relatively easy to perform with custom code and which tasks would not. Often the difference between the two (tasks

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within reach and tasks requiring far more time and effort than we had available) was not due to the *type* of task itself (e.g., identify string citations) but to related considerations such as the ways and extents to which the data format varied. Some of these variations are meaningful to humans (e.g., Chicago style vs APA style), but other variations (e.g., a line break within a citation) are not meaningful to humans and therefore may be overlooked by researchers without coding experience. When discussing the variations for which our extraction process needed to account, we needed not only to identify all such variations but also discuss them in ways that all three researchers found meaningful if we were to collaboratively pursue a solution. In this case, that meant using examples of variations in data format to get everyone on the same page.

Our structured communication, informed by shared documentation that included a glossary and spelled out the specifics of the coding logic, may seem unnecessarily formalized. However, we found such documentation to be essential for streamlining our work and propose that such documentation could be even more valuable in industry settings, especially because the time-intensive nature of our corpus analysis method could be a barrier to practitioners. Practitioners working in industry settings may not always have access to all individuals involved in the development of their projects. For example, organizational structures in software companies may restrict technical writers to only writing roles. In these roles, technical writers may not have access to user research teams or to resources that would enable them to conduct data-based research. In the context of such restrictions, shared internal documentation could provide important context for technical writers: e.g., conveying constraints relevant to the tasks performed by colleagues in other departments/ roles, as well as establishing a shared vocabulary for project tasks.

Initiating an interdisciplinary project by developing internal documentation is a practice that enacts relational values. This practice prioritizes a shared vocabulary and understanding of project goals, which can deepen mutual respect for and understanding of each member's project contributions. By first establishing a shared [written] foundation and *then* developing research methods that involve programming and humanistic skills, this practice privileges people over objects (Wolfe, 2009) and projects a humanities

ethos over an engineering one (Wolfe, 2009). Therefore, we suggest that this practice is also relevant to TPC instructors who are training the future workforce. Collaborative projects in interdisciplinary courses offer many benefits, such as boosting conscious participation in problem solving through articulation and other communication practices (Ranade & Swarts, 2019), and this lesson learned about the role of communication (especially shared internal documentation) can support such projects in classroom environments.

Iterative scoping: Responding dynamically to challenges

In big-data projects requiring hybrid approaches (computer and human labor), it can be easy to lose focus on the project goals and accidentally produce outcomes that do not directly, specifically align with the research questions. We started the project with broad, exploratory questions, gradually scoping into specific research questions as the project progressed. The initial openness allowed us to prioritize extracting and cleaning data over locking in a project scope. To remind ourselves to revisit the research questions, we included them at the top of our project documents, such as the coding logic document which described specific tasks and included the glossary of shared terms. Revising project scope required revising research questions. One challenge to revising scope was distinguishing between difficult-but-possible tasks and not-possible-for-now tasks. We found team-capacity considerations useful in distinguishing these tasks. Team capacities could be expanded to some extent, but we decided that coordinating more than a three-person team would introduce too much additional complexity to an already-complex project.

As the project progressed, and we began to more fully understand the complexities and challenges of identifying and extracting string citations from such a large and diversely formatted corpus, Walton consistently drew the team back to our research questions to help us make decisions regarding a range of issues we encountered along the way. For example, as the custom code was iteratively developed and tested, we returned to the research questions to ensure that the output would, indeed, support us in answering the research questions. When differences in citation style (Chicago vs. APA) required the creation of two

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sub-corpora for separate analysis, we revisited the research questions again to ensure that our process for extracting string citations would produce outputs that could be meaningfully analyzed for implications of inclusivity. Drawing upon her research experience, Walton's role in the project included ensuring that our dynamically changing approach and project scope continued to align with our research questions, paving the way for a more concrete and achievable project design. This consistent and iterative revisiting of the research questions not only clarified our decision making but also informed our understanding of the claims we could ultimately make based on the broader project.

RQ2. Assigning Computer and Human Tasks

The process for determining which tasks should be conducted manually (by human labor) versus automated (by computer code) was not as straightforward as one might assume. Common sense suggested allocating low-cognitive, repetitive tasks to computers and complex socially informed reasoning to humans. But we discovered that the messy, inconsistent, and complex formatting of data may require humans to do some of the low-cognitive, repetitive tasks. While the limitations of one (human or computer) might be the other's strength, understanding limitations of both human and computer labor is a crucial component in refining project scope. An important early task for us in designing this research project was to develop the theory-to-query method that required clearly defining our project's parameters by creating a coding logic document to act as both a programming schematic and a glossary to communicate and negotiate the limitations of this project to fit researcher capacities (both time and resources). But we suspected that even with unlimited time and resources, the data itself—its state, format, and availability—would impose limitations that direct much of who (human or computer) does what.

Limitations of human labor

While human labor might produce accurate data for repetitive tasks that require a modicum of critical reasoning, that accuracy can be impeded by the volume of those repetitive tasks. In other words, human brains grow weary and make mistakes. To help prevent such errors, we broke down the major goal of data extraction into discrete tasks that we then tested, refined, and

retested. For example, expanding the computer output (Table 2, Column C) required converting ranges (e.g., [1]-[3]) into individual numbers (e.g., 1, 2, 3). This process, though simple, required the recognition and the input of several numbers that were not always listed in a string (such as the number 2) and did not always occur in order. Although all PubCites listed in any given string citation were in numerical order (e.g., [1]-[3]), each string citation in an article could have any range of PubCites (e.g., [5]-[7], [9], [43]-[52], [90]). Therefore, to mitigate human error, we used a simple spreadsheet formula to eliminate repetition and create an ordered list. Such resources (i.e., spreadsheet formulas) enable the automation of narrow, specific tasks without the development of custom tools using programming languages like Python. We see an important implication here for interdisciplinary teams in academia and in industry who are working on big-data projects: remember that automation (i.e., computer labor) can be built into tasks using a range of resources. Just because the ultimate project goal (in our case, identifying and extracting string citations) cannot be accomplished with extant tools, such tools can still prove useful to conducting or optimizing specific sub-tasks.

Limitations of computer labor

Variations in the formatting of APA-style string citations make it difficult to create a custom computer program that can identify and analyze each instance of in-text citations. Even identifying the individual PubCites listed in APA-style string citations is complicated. For example, to begin the process of determining if a PubCite is a StringPub, our custom computer program needed to first identify every string citation. Luckily, in APA style, all string citations are contained within a parenthesis with the individual PubCites separated by a semicolon. This format provided a pattern for which a computer program can search. However, when strings are identified, getting the custom program to then parcel the individual PubCites within the string proved extremely difficult. In the fictitious string citation example "(Aarons, 2012; Black Horse, 2017; Change, Liu, & Billingsly, 2013; Hassan, 2015)," the custom program would need to split this information apart and reformat it to be understood as "Aarons (2012)" "Black Horse (2017)," "Change, Liu, & Billingsly (2013)," and, "Hassan (2015)." This proved to be a challenging task due in part to

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formatting problems introduced into the references list when converting TXT files into PDF files. These formatting problems made parceling out data too challenging to complete in the first stage of this project, causing us to prioritize the Chicago-style sub-corpus for data refinement, as described in the Methods section.

IMPLICATIONS AND FUTURE WORK

TPC is particularly concerned with defining and legitimizing our identity as a field (Kynell-Hunt & Savage, 2003), and one of the clearest reflections of a field's identity is its research (Rude, 2009). TPC research has been analyzed in a number of ways for its reflection of the field. For example, Rude (2009) conducted a corpus analysis of the introductions or prefaces of 109 books on TPC. Arguing that "the identity of any academic field is based in part on the research it conducts" (p. 175), Rude created a map of the field's research questions to convey that identity. Boettger and Friess pursued a similar line of inquiry, conducting a mixed-methods analysis of a large sample of TPC scholarship to identify norms in article titles (2014) and common research topics (2016). These studies demonstrate that corpus analysis offers a particularly appropriate way to understand a field as a whole, including not only its topics but also its values.

Other TPC scholarship connects the field's research and its values even more directly. For example, Blakeslee (2009) explored the field's research using a survey to identify values and constraints that shape the work of TPC researchers. Four years later, a collaborative group of TPC academic scholars and industry professionals conducted a survey to identify open research questions in the field and to compare the research priorities of scholars and practitioners (Andersen et al., 2013). These studies frame TPC research as a reflection of the field's identity, priorities, and values by tracing large-scale patterns across the field's published research and identifying implications of those patterns for what the field finds to be important and worth studying.

Arguably, analyzing a field's research for its gaps, for what and *who* is missing, offers an even more important reflection of the field's values. Some of the most influential TPC scholarship in this vein is that of Isabelle Thompson. A feminist researcher, Thompson conducted multiple corpus analyses of TPC publications using big-data techniques to investigate the field's inclusivity of women and feminism. Her 1996 review of TPC journal articles identified which theoretical frameworks, including feminist frameworks, were most influential in scholarship published between 1990 and 1994. Thompson (1999) later expanded her inquiry to include TPC articles published between 1989 and 1997: determining the frequency of scholarship that focused on women or feminism and analyzing their representation by identifying thematic trends. Arguing the importance of seeking out and valuing underrepresented perspectives, Thompson (1999) stated,

> Critiques of current and historical practice in technical communication can make us aware that common sense often means unquestioned discrimination. … In applying research to practice, we need to keep in mind the interdisciplinary roots of our discipline and the openness and flexibility that can result from this tradition. … Changing the workplace and the world—and determining the nature of technical communication as a discipline—can best be achieved by learning from all viewpoints and valuing all perspectives. (p. 175)

Thompson's work is important for understanding the field over time, gauging certain types and levels of inclusivity reflected not just in calls to action but also in our actions themselves as reflected in the body of our field's scholarship. To enable this longitudinal understanding, Smith and Thompson (2002) extended Thompson's original analysis to include scholarship published between 1997 and 2000, expanding their scope to investigate citation practices of TPC articles focusing on women and/or feminism. Their work has been extended twice more (Thompson & Smith, 2006; White, Rumsey, & Amidon, 2016). This body of scholarship demonstrates that, although the field became more inclusive of feminist topics and frameworks over the last two decades, people are still being marginalized through scholarship practices, workplace practices, and technical communication products because of their gender identity. We were inspired by this body of research, which uses big-data techniques to analyze a corpus of scholarship for what is present, who is missing, and the implications of those patterns for the inclusivity of our field.

This case history presents the theory-to-query method we developed and problem solving we

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undertook to identify and extract data for a larger research project on citation patterns. Narrowing our focus to string citations offered an attainable scope that preserved our original concern with citation practices that Delgado (1992) identified as "mechanisms" of marginalization (p. 1351). In analyzing the nuances and impacts of string citations in TPC scholarship, our broader study can offer one way to gauge scholarly inclusivity at a field-wide level. To approach such a project, however, we had to first develop a method to identify and extract string citations from a large body of the field's scholarship. This initial hurdle was achievable through designing a computer program using the theory-to-query method. Future work will report findings of the broader study of citation patterns enabled by this method.

Our initial data suggests that a large proportion of scholarship is cited *only* within string citations. Table 2 provides a snapshot of this pattern: In this instance, Fuller, Marett, and Twitchell (2012) used 24 string citations in their article, and those string citations referenced 42 specific publications (42 PubCites). Of those 42 PubCites, 30 were StringPubs (i.e., cited in the article *only* within a string citation). The commonality of StringPubs (197 articles in our Chicago sub-corpus had at least 1 StringPub: 83.8%) suggests that TPC scholarship could engage more deeply and specifically with cited scholarship. We find this pattern compelling and believe it offers a rich area for future study. Delgado (1992) warns that failing to engage with a cited article's particular argument could signal marginalizing citation practices. However, we want to note that string citations, themselves, are not unethical and do not necessarily operate to marginalize. It is a matter for critical human analysis to distinguish between use of string citations that are problematic versus those that are not. With string citation data identified, extracted, and refined, we are poised to undertake that critical human analysis, thanks to the computer program we created using the theory-to-query method presented in this case history.

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APPENDIX A: INITIAL COMPUTER CODING LOGIC SAMPLE

RQ1: At what rate is TPC scholarship citing authors only within string citations?
(i.e., What's the proportion of PubCites that are StringPubs?)

GLOSSARY:
PubCite: A single publication cited in a text.
StringPub: A publication that is cited only within string citations in a text.

LOGIC:
1. Search CORPUS (all texts, n=777) for total number of articles cited (this gives number of PubCites per text, which we could add to know the number of PubCites in CORPUS A)
    a. Spot check a few texts manually for number of articles cited
    b. Split CORPUS (all texts, n=777) into sub-corpora based on citation style.
2. If the article uses APA-style, then add to **APA-style sub-corpora**. Else, add to **Chicago-style sub-corpora**.
3. Refine search for string citations (examples in APA-style)
    Example of starting output:
    2020_TCQ_v29i1_Doodlebob.txt: (Agboka, 2014; Agboka & Matveeva, 2018; Haas, 2012; Jones, 2016a; 2016b; Ranade & Swarts, 2019; Walton Moore, & Jones, 2019, Walwema, 2018), (Agboka 2014; Haas, 2012; Jones, Savage, Yu, 2014; Walton et al., 2019)
    a. Parcel out individual pubs from strings. (This is an alphabetized list of all pubs in string citations within a single text)
    Example first refinement:
    2020_TCQ_v29i1_Doodlebob.txt: 2016b; Agboka, 2014; Agboka, 2014; Agboka & Matveeva, 2018; Haas, 2012; Haas, 2012; Jones, 2016a; Jones, Savage, Yu, 2014; Ranade & Swarts, 2019; Walton et al., 2019; Walton Moore, & Jones, 2019; Walwema, 2018
    b. Cancel string repeats (only within each text file's results). **Keep only one occurrence of each pub (PubCite) in results from each text file.**
    Example second refinement:
    2020_TCQ_v29i1_Doodlebob.txt: 2016b; Agboka, 2014; Agboka & Matveeva, 2018; Haas, 2012; Jones, 2016a; Jones, Savage, Yu, 2014; Ranade & Swarts, 2019; Walton et al., 2019; Walton Moore, & Jones, 2019; Walwema, 2018
        i. Erased extra occurrences of Agboka, 2014 and Haas, 2012.
        ii. Add the "Jones" to the "2016b" cite—I'm not sure how to do this.
            1. Do we need an index for this?
        iii. Create initial output. Make index file/s for "et al." and "multi-author" entries.
4. Remove/block search of inputs in texts after the word "REFERENCES" occurs
    a. This prevents the program from counting the reference of any particular author/text as a "citation."
5. Search text file for other non-string PubCite occurrences
    a. If PubCite in-text citation instances >=1 only **within string citations formatting**, then keep. Else, cut. (I.e., if PubCite >1 outside of string citation, then cut.)
    Example citation instance: "Haas (2012) argued that…"
    If PubCite only occurs within a string citation, even if it is multiple times, then keep.
6. Refine results to subsume Walton et al., 2019 into Walton, Moore, & Jones, 2019 results using index file created in step 3biii.
    a. This refinement should follow the "If PubCite >1 outside of string citation, then cut" rule.
    b. Individual citation could be a simple parenthetical cite (Haas, 2012), or embedded within sentences.
7. Create output spreadsheet of each text filename that has >=1 PubCite in-text citation instances >=1 only **within string citations formatting**.
8. **Save results for RQ1**.

StringPub Identification Protocol for APA and Chicago Documents

Definitions

A 'PubCite' is a single reference cited in a document. For example, if a document lists 45 references, it has 45 PubCites.

A 'StringPub' is a PubCite that is used only within string citation/s in a document in a "generic" fashion. For example, if a PubCite is cited 10 times in a document, but all of those citations are part of strings without any individual context, then it is a StringPub.

Identification Protocol

StringPubs are identified based on their use within a single sentence.

1. Is the PubCite located within a string citation in the document? In other words, is the PubCite located within a sentence as part of a list of *two or more* PubCites?
   a. Four examples:
      i. "Scholars are interested in balloons [1]-[5]."
         ➢ There are five PubCites in this example.
      ii. "Scholars are interested in balloons [1-5, 7]."
         ➢ There are six PubCites in this example.
      iii. "Scholars are interested in balloons (Aardvark, 2018; Beluga, 2017)."
         ➢ There are two PubCites in this example.
      iv. "Scholars are interested in balloons (Beluga, n.d., 2017, 2018, in press)."
         ➢ There are four PubCites by a single author in this example.
   b. If YES, this may be a StringPub. Proceed to the next question.
   c. If NO, this is <u>eliminated</u> as a StringPub. List in the REJECTS column and start the next PubCite inquiry.

2. Is the PubCite in a sentence *on its own*, or as part of *its own* short phrase or quote, anywhere in the document?
   a. Four examples:
      i. "Aardvark states, 'Scholars are interested in balloons' [1]."
         ➢ This sentence contains only one PubCite.

Practicing Technical Communicators' Experiences with and Perspectives on Academic Publishing

By Rebekka Andersen and JoAnn Hackos

ABSTRACT

Purpose: Most refereed journals in the field of technical communication have as a goal to publish research articles on problems, trends, and practices in the field to meet the needs of readers working in both industry and academia. But academic researchers and journal editors know little beyond anecdotal stories about what industry readers actually think about the research articles they read in the journals.

Method: To better understand practitioner experiences with and perspectives on academic research, we conducted a 25-question survey of 187 practicing technical communicators. Questions focused on experience with trade and academic publications; interest level in reading academic articles based on titles and abstracts; types of publications and content found most useful, valuable, and relevant; and suggested changes for how academic research is designed or reported.

Results: The majority of respondents were either unfamiliar with or never or rarely read research published in the six main journals in the field. Common reasons given included difficulty finding and gaining access to journal articles, difficulty parsing practical applications, and difficulty making sense of dense and convoluted writing. But respondents also expressed strong interest in published research that has readily evident practical applications and relevance to current work practices.

Conclusion: Academic research in the field has the potential to reach and impact much wider audiences. We offer specific suggestions for how journals, professional organizations, researchers, and practitioners can better promote and increase access to published research and increase its relevance, value, and accessibility for industry readers.

Keywords: Academic research, value, relevance, accessibility, practitioner perspectives

Practitioner's Takeaway

- Practitioners are interested in academic research that is readily visible and accessible, that is relevant to current work practices, that emphasizes practical applications, and that is easy to read and understand.
- Practitioners can help shape the focus, design, and reporting of research by collaborating with researchers, offering work sites as study sites, serving on journal review boards, and offering journal editors constructive feedback.
- Practitioners can gain access to articles of interest by emailing authors directly or by looking for pre-published versions on Academia.edu, ResearchGate.net, or on the open access repository of a researcher's institution.

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INTRODUCTION

In November 2016, *Technical Communication* published a special issue on "Communication of Research Between Academic and Practicing Professionals," edited by Mike Albers. The issue was devoted to exploring ways to improve the communication of research results between the field's academic and practitioner communities. In his editorial introduction, Albers defined technical communication (TC) as a social science discipline with practical application and claimed that it thus stood "to reason that [TC] research should, if not be directly applicable, at least be understandable by those practitioners" (p. 293). But most academic research, he argued, was largely disconnected with practitioner research needs and poorly communicated to practitioners.

That special issue highlighted what we see as a significant problem facing the field of TC today: academic research, as both written and disseminated, is largely inaccessible to practitioners, and the value and relevance of the research to the problems that practitioners are trying to solve is often unclear (Albers, 2016; Blakeslee & Spilka, 2004; Clark, 2004; Dicks, 2002; Rude, 2015). Articles in the special issue described various dimensions of the academic and practitioner divide and offered research-informed recommendations for strengthening research-practice, academic-practitioner connections.

St.Amant and Meloncon (2016), for example, problematized the lack of practitioner voice in academic research and thus sought to better understand what research topics practitioners thought were important to examine and what research approaches they thought would work best to examine them. Through 30 asynchronous interviews with practitioners, St.Amant and Meloncon not only identified topics and approaches of interest but also learned that practitioners wanted more research to focus on real problems and audiences and to highlight applied results. Boettger and Friess (2016), too, found vast discrepancies in the topics most discussed in the field's core professional and academic forums. To unify research, they called for more structured abstracts and implications statements across forums and for academics to identify new audiences and to engage more practitioners in their research.

Although the special issue from 2016 laid important groundwork for how the field can better sustain research-practice feedback loops, the issue as a whole focused more on identifying practitioner research interests, needs, and desired research approaches than on understanding practitioner experiences with academic research and practitioner-suggested strategies for improving the communication of research.

We thus wanted to build on the work published in that special issue by designing a study aimed to understand practitioner experiences with and perspectives on academic research, including practitioner suggestions for how the communication of academic research might be improved. We knew that to understand suggestions we needed to also understand underlying perspectives and experiences.

Our main research questions were as follows:

- What are practitioners' experiences with academic publishing and/or research in technical communication?
- What kinds of academic research are practitioners most interested in reading and why?
- What kinds of publications and published content do practitioners find most useful for solving problems and/or improving processes and practices?
- How can the communication of academic research to practitioners be improved?

Our study included a 25-question survey of 187 practicing technical communicators, or people who worked as TC practitioners in non-academic contexts (e.g., as information developers, content strategists, technical editors). For each main research question, we asked a set of closed- and open-ended survey questions.

In this article, we offer a brief overview of the goals and intended audiences of the major research publications in the field followed by a brief discussion of why research focused on improving practice has been limited since the 1990s, despite several initiatives and numerous researchers who have called for and defined opportunities for conducting more research focused on practice. We then describe our study and report both quantitative and qualitative results of the survey. We end with a discussion of the primary concerns that practitioners raised about academic research, offering ideas for how journals and professional organizations might better promote and increase access to research and how authors and journals might increase the

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relevance, value, and accessibility of published research for non-academic readers. In this article, we use *accessibility* to refer to how academic research is both written and disseminated; we do not use accessibility to refer to the extent to which articles meet web or document accessibility guidelines.

BACKGROUND

The Need to Understand Practitioner Experiences with and Perspectives on Academic Research

Practitioners' experiences with and perspectives on academic research are important to consider because most refereed journals focused on TC have as a goal to publish research articles on problems, trends, and practices in the field to meet the needs of readers working in both industry and academia. As Table 1 shows, this primary aim is articulated in the aims and scope statements of five of the six refereed journals in the field (*Technical Communication Quarterly* being the exception, as its aim statement, at the time of this study, did not specify intended readers).

But neither authors of academic research nor journal editors or reviewers know much beyond anecdotal stories about what practitioner readers actually think about research published in the journals, including the extent to which they find the theory and research results applicable, relevant, and valuable. In an editorial in *Technical Communication*, deJong (2009) reflected on the journal's aim of bridging the academic and professional world and commented, "I would be more than interested to see how technical communication professionals use and judge academic research contributions" (p. 98).

Research stakeholders would benefit a great deal from data that speaks to the frequency with which practitioners are reading the journals and the extent to which research topics and approaches, as well as the communication of research results, are meeting their needs.

The Disappearance of the "Improving Practice" Research Trajectory

It is no secret that academic research in TC has a reputation among practitioners of being irrelevant,

Table 1. Goal and audience descriptions of refereed journals focused on technical communication

Communication Design Quarterly: "seeks to become the premier information source for industry, management, and academia in the multidisciplinary field of the design and communication of information" and publishes articles of "potential value" to its readership population of "researchers and practitioners of the design of communication"
IEEE Transactions on Professional Communication: "devoted to applied research on professional communication" and publishes papers that "address the research interests and needs of technical communicators, engineers, scientists, information designers, editors, linguists, translators, managers, business professionals, and others from around the globe who practice, conduct research on, and teach others about effective professional communication"
Journal of Business and Technical Communication: "designed to disseminate knowledge that can lead to improved communication practices in both academe and industry" and thus "favors research that will inform professional communicators in both sectors"
Journal of Technical Writing and Communication: "strives to meet the diverse communication needs of industry, management, government, and academia," and "performs as the needed bridge between academia and the world of practitioners"
Technical Communication: emphasizes "the combination of academic rigor and practical relevance" and publishes articles that address the interests of the journal's readers who are primarily "active practitioners of technical communication"
Technical Communication Quarterly: publishes research articles that "combine theoretical and practical perspectives" and focus on "technical communication in academic, scientific, technical, business, governmental, and related organizational and social contexts"; articles include "implications for teaching, research, or practice in technical communication"

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too theoretical, too abstract, and difficult to access and understand. This reputation has been addressed in various publications and forums over the years (see, e.g., Albers, 2016; Andersen & Hackos, 2018; Bosley, 2002; Johnson, 2010 & 2018).

Rude (2015) explained the reputation in terms of the two research trajectories that the field has followed: the "improving practice" trajectory and the "exploratory" trajectory (see Figure 1). The improving practice trajectory was the focus of a great deal of research in the field in the 1980s and early 1990s; academic researchers were interested in studying workplace practices and connecting research with practitioner needs. Seminal works still referenced today include, among others, Rachel Spilka's study of orality and literacy in the workplace (1990), Stephen Doheny-Farina's study on writing in an emerging organization (1986), Karen Schriver's *Dynamics in Document Design* (1996), and Dorothy Winsor's *Writing Like An Engineer: A Rhetorical Education* (1996).
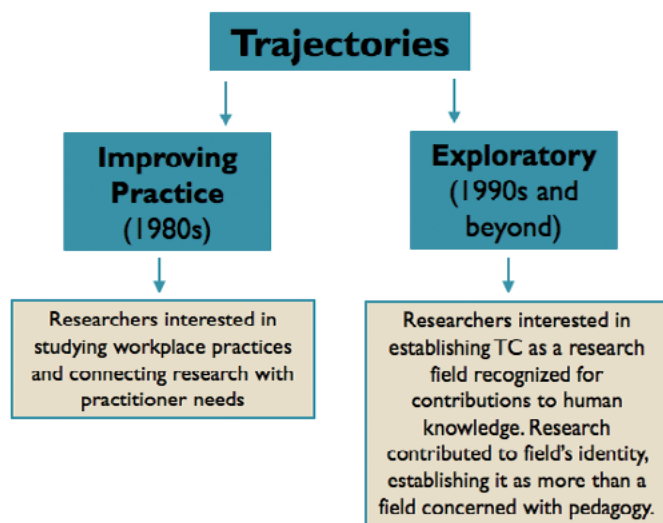
Figure 1. Improving practice and exploratory research trajectories in technical communication (reflects Rude's explanation of the trajectories)

In a 1985 special issue of *Technical Communication* focused on "Research in Technical Communication," editor Thomas Pinelli argued that the primary purpose of research should be to inform practice and that "good solid research advances the state of the art by contributing to the body of knowledge that in turn is applied to solve the numerous problems faced each day by practitioners" (pp. 6-7). At the time, research in the field had been limited; the issue thus served as a

call for growing the body of research focused on TC, particularly research focused on the work problems practitioners needed to solve.

Beard, Williams, and Doheny-Farina (1989) noted in a follow-up article, "Directions and Issues in Technical Communication Research," that despite wide agreement on the need for research that improves practice, practitioner input on research was largely lacking. To address the gap, the authors conducted a forum and survey at the 1987 International Technical Communication Conference to gather practitioner input on goals and directions for research as well as practitioner perspectives on published research in the field. The authors in particular wanted to find out if practitioners consulted published research and, if so, if they found it "valuable in solving their work problems" (p. 188). Interestingly, the vast majority of participants indicated that they regularly read published research, found the research helpful, and felt research was essential to evolving the profession (p. 190).

Rude (2015) suggested that interest in research focused on improving practice largely disappeared in the 1990s when the exploratory trajectory took off. She explained that researchers sought to establish TC as a research field recognized for its contributions to human knowledge; they thus began conducting research that focused primarily on "the ways in which texts act in the development and mediation of knowledge in a variety of settings" (p. 4). This research contributed to the field's identity, establishing it as more than a field concerned with teaching and practice. A consequence of the exploratory trajectory pushing the boundaries of the field, however, has been limited research focused on improving practice.

Other cited reasons for limited research focused on improving practice include varied barriers to conducting applied research, particularly those of time, funding, rewards, and access. Blakeslee (2009), for example, found that researchers lacked the time, funding, and necessary institutional and departmental support and recognition (pp. 135-136). Further, promotion and tenure committees continue to value theoretical research and thus researchers on the tenure track often feel discouraged from conducting research designed to improve practice (a point Bosley, 2002, aptly makes).

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The Many Calls for More Applied Research

Despite the challenges of conducting practice-focused research, many academic researchers agree that there is tremendous value in research that grows out of practice and that feeds back into practice (see, e.g., Albers, 2016; Andersen, 2011 & 2014; Rude, 2015). In fact, there have been numerous calls in the past 15 years for more research focused on improving practice. Davis (2013), for example, drew parallels between TC and other practice-oriented disciplines, arguing that "Ours is, like medicine and engineering, a discipline that must be immersed in solving real-world problems" (p. 30). Rude (2009), too, emphasized these parallels, suggesting that the knowledge we produce through research "must be recognized as enabling better work and use of the products it helps present to users" (p. 205). Interested in gauging the perspectives of 20 prominent researchers in the field, Blakeslee and Spilka (2004) found universal agreement that researchers need to investigate more research problems that industry considers important and that this research should lead to guidelines and best practices for the field.

The calls for more applied research and research that addresses defined needs have been answered by some. Two initiatives, the 2000 Milwaukee Symposium (see Mirel & Spilka, 2002, pp. xv-xvi) and the 2012 Industry/Academy Research Initiative (see Andersen, 2013a & 2013b; Benavente et al, 2013) serve as two prominent examples. The goals of both initiatives were to build stronger connections between research and practice and define shared research priorities—the outcome of both being a comprehensive list of research questions in need of scholarly and practical investigations aimed at improving practice.

Several seminal studies focused on improving practice, as well, have been published since the exploratory trajectory took off. These studies offer guidelines and heuristics that practitioners continue to apply to local contexts. Among others, example studies include Judy Ramey's set of usability heuristics for website design (Ramey, 2000); Mike Albers's and Loel Kim's study of browsing behavior of users searching for information on a handheld device (Albers & Kim, 2002); David Dayton's study of on-line editing by technical editors (Dayton, 2004); and Grice et al.'s usability heuristics and metrics for information products (Grice et al., 2013). These studies were published in *Technical Communication* and supported by the former STC Research Grants Program, which aimed to support practice-oriented research of value to practitioners. Other notable studies, also among others, have focused on best practices for creating instructional videos (ten Hove & van der Meij, 2015; Swarts, 2012); productive author-editor relationships (Eaton et al, 2008; Mackiewicz & Riley, 2003); strategies for increasing success in adoption of content management systems (Andersen, 2014; Gollner et al., 2015); project management for development teams (Lauren, 2018); and collaboration in international virtual teams (Brewer, 2015).

RESEARCH METHODS

Given the aims of refereed journals in the field and renewed calls for more applied research, we wanted to learn the extent to which practitioners were reading research and whether they found the research helpful for problem solving. We wondered how experiences with and perspectives on academic research had changed since Beard, Williams, and Doheny-Farina (1989) conducted their survey of practitioner experiences and perspectives.

We thus designed a 25-question survey, employing what Creswell & Creswell (2017) called an "explanatory sequential design," where the "intent is to first use quantitative methods and then use qualitative methods to help explain the quantitative results in more depth" (p. 6). Because we wanted to understand survey participants' reasons for selecting the answers that they did, we included several open-ended questions on the survey inviting participants to share their stories and experiences. Responses to open-ended questions thus allowed us to better understand why participants viewed academic research the way that they did and how they imagined communication of academic research being improved to increase its value and relevance.

In addition to the survey, as part of a larger study, we conducted a series of interviews with practitioners who were established consultants or who were in managerial or senior positions in their organizations. We reported the results of the interviews in the paper "Increasing the Value and Accessibility of Academic Research: Perspectives from Industry," published in the *Proceedings of the 36th ACM International Conference on Design of Communication* (2018).

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Study instruments and recruitment materials underwent a full review from the UC Davis Institutional Review Board (IRB).

Survey Design

We designed the 25 closed- and open-ended question survey in an advanced version of Survey Monkey (Advantage Plan). The survey took respondents 30-45 minutes to complete.

The survey first asked questions about respondents' roles as technical communicators and experiences with publishing in the field. It then asked respondents to review 18 titles and then 18 abstracts of articles published in recent issues of the six refereed journals in the field of TC (see Table 1). Titles and abstracts were included in the survey because we knew, based on our own experiences, that many practitioners would not be familiar with academic research; we thus wanted them to react to actual titles and abstracts rather than to assumptions or distant memories that they had about academic research. We selected three article titles from the most recent issue (as of May 2016) of the six journals. There were two exceptions:

Because one of us edited the March 2016 special issue and the September 2015 special issue of one of the journals, we included titles from the June 2015 issue (abstracts were included from the December 2015 issue).

Because the April 2016 issue of another journal focused on teaching and academic labor issues and the October 2015 issue included a series of commentaries from veteran academics, we selected titles from the July 2015 issue (abstracts were included from the January 2016 issue).

We selected 18 article abstracts from the same six journals in the issue published prior to the most recent issue, for a total of three abstracts from one issue of each journal (two exceptions described above). We did not include abstracts that focused on teaching or science policy or science communication. Journal editors, and in some cases editorial boards, granted us permission to use all abstracts included in the survey; neither the publishing journals nor article authors were identified.

We first asked respondents to review the titles and, next to each title, select their level of interest in reading the full article (Very Interested, Somewhat Interested, Not Interested). Respondents had the option of explaining why they might be interested in reading

some of the articles but not others. We then asked respondents to review the abstracts and, next to each abstract, select their level of interest in reading the full article. Here, too, respondents were given the option of explaining their selections, and they were encouraged to describe their overall reaction to the article abstracts.

The survey ended with a series of closed- and open-ended questions about respondents' personal experiences with and perspectives on academic publishing, including suggestions for how the design or reporting of academic research might be improved so to increase its relevance, value, and/or accessibility for practicing technical communicators.

Closed-ended questions included an "Other" option when appropriate and allowed respondents to enter their own answers (e.g., when asked to name the titles and/or areas of emphasis of the degrees or programs completed). Of the 23 closed-ended questions, seven offered respondents the option to "Please explain, if desired"—this option allowed us to collect qualitative comments to help us better understand quantitative selections.

We pilot tested the survey with three TC practitioners and revised it based on their feedback. The survey opened May 17, 2016 and closed June 28, 2016.

Survey Recruitment

We distributed the survey to a mailing list hosted by the Center for Information-Development Management (CIDM) and to 11 TC-focused LinkedIn groups that each had 1000 or more members. The CIDM is a professional organization that brings together managers of information development teams and thus largely comprises experienced practitioners in decision making positions; the mailing list included both members and non-members of the CIDM. The 11 TC-focused LinkedIn groups included the CIDM, Content Management Professionals, Documentation and Technical Writing Management, Documentation Managers, IEEE Professional Communication Society, Society for Technical Communication, Technical Writer Forum, Technical Writing and Content Management, Technical Writer in Action, Technical Publication and Documentation Managers Forum, and The Content Wrangler Community.

We used purposeful sampling in distributing the survey announcement and instrument to these groups because we wanted to specifically recruit practicing

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technical communicators. In the announcement that we sent to the CIDM mailing list and to the LinkedIn groups, we clarified our inclusion criteria through two opening questions: Are you a practicing technical communicator? Are you interested in research that can help you address problems and understand trends in the field? We followed these questions with the following statements:

> If yes, please take this survey to help us identify how academic research in the field of technical communication can be better communicated and made more accessible to you. We want to hear about your experiences with and perspectives on academic research, and we want to know what kind of research you find most valuable and relevant.

For practicing technical communicators who might have felt disqualified due to not being familiar with academic research in the field, we further clarified that respondents did not need to be familiar with academic research to complete the survey and that the survey included sample titles and abstracts of research-based articles for their review and response.

All survey respondents, regardless of whether they completed the full survey, were invited to enter a drawing to win one of eight $50 Amazon gift cards.

Analysis

We did not attempt to establish statistical relationships among variables. For closed-ended responses, percentages and frequency counts were calculated by students enrolled in a Communication in Statistical Collaboration course at Virginia Tech (they were senior Statistics majors). The students conducted exploratory data analysis using descriptive statistics to create graphical representations of data distributions.

We analyzed open-ended responses looking for common themes in response to the questions. After identifying the main themes, we reviewed responses again and coded all instances of the theme. We then pulled comments that, in our professional judgement, best represented identified themes for each question.

RESULTS AND DISCUSSION

In this section, we report descriptive results of the survey. We organize our reporting of results based on the five general categories of questions asked (these categories reflect our main research questions):

- professional and educational background
- experience with trade and academic publications focused on technical communication
- interest level in reading academic articles based on titles and abstracts
- types of publications and content found most useful, valuable, and relevant
- suggested changes for how academic research is designed or reported

Because not all respondents answered every question, we identify the number of respondents for each survey question. A total of 187 people took the survey.

Professional and Educational Background

Questions one through five asked respondents to share information about their professional and educational background. We first asked respondents to identify their role or roles in their organization and the number of years they had worked in the field of TC. We then asked respondents to describe their educational backgrounds.

Organizational roles and years in field

Respondents were asked to identify their role or roles in their current organization. We listed 17 roles plus an "Other (please specify)" option. The list is regularly used on surveys conducted by the CIDM. Figure 2 shows the range of roles represented by respondents (the total is greater than 187 because this was a "check all that apply" question).

Figure 2. Role or roles in current organization (n=187)

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Over 68% of respondents identified as technical communicators (n=128), while 42% identified as information developers (n=79) and 40% as content engineers or content strategists (n=74). The role of information architect (n=63) and editor (n=54) were also common. Given recent reports pointing to a decline in traditional technical writer roles and an increased need for people who can work with content at a strategic level (see, e.g., Kimball, 2016; Molisani & Abel, 2012), we were not surprised to see that nearly as many respondents identified as content engineers or content strategists as did information developers, a title that has largely replaced that of technical writer. Of those respondents who selected "Other" (n=23), however, six specified "technical writer" as their role.

Respondents were also asked to indicate for how long they had worked in the field. More than 70% of respondents (n=136) had worked in the field for more than 11 years, with 35% having worked in the field for more than 21 years (n=65). Notably, 56% of respondents indicated that they were working in management (n=105), and 35% had worked in management for four or more years (n=66). These numbers tell us that the majority of respondents were experienced technical communicators working in decision-making positions; the majority were thus well positioned to evaluate the relevance and value of academic research as well as to apply research results.

Educational background

We also wanted to know what degrees or programs respondents had completed as well as the titles and/or areas of emphasis of those degrees or programs.

In total, 76% of respondents (n=140) reported having completed a bachelor's degree or higher (of the total 184 respondents who answered this question). This percentage includes those who had completed a master's degree (n=79), PhD (n=9), or post-baccalaureate program (n=4). Additionally, 21% of respondents (n=40) indicated that they had completed an academic or professional certificate, and 17% (n=32) indicated that they had completed a professional certification.

Of those who reported having completed a bachelor's degree or higher, the disciplines or foci of the degrees varied widely. Degrees represented STEM fields, the social sciences, the liberal arts/humanities, and business/management.

Figure 3 presents a breakdown of the titles or areas of emphasis of completed bachelor's degrees.

Figure 3. Titles and emphasis areas of bachelor's degrees (n=147)

Because respondents were asked to self-report titles and emphasis areas, answers were wide ranging and written in varied ways (e.g., "Communications" versus "Mass Media and Marketing"). We classified titles and emphasis areas into general disciplinary areas, as represented in Figure 3. Some respondents had completed two bachelor's degrees and hence we received 147 responses (important to note given that only 140 respondents indicated having completed a bachelor's degree). We did not specify what counted as an "emphasis area"; these might include minors, concentrations, or certificates.

We included in the "English (various flavors)" category titles and emphasis areas typically offered through traditional English Departments, such as "English literature and rhetoric" and "English, with an emphasis in writing." Because we wanted to know how many respondents focused on professional and/or technical writing in their undergraduate education, we counted any titles or emphasis areas that mentioned professional and/or technical writing (or communication) as a separate category. If a respondent completed a bachelor's degree in English with a concentration in professional writing, for example, we counted that response as professional and/or technical writing, not English. However, if a respondent listed three emphasis areas, such as political science, philosophy, and business and technical writing, we counted that response as three unique areas (Social Science, Humanities/Liberal Arts, and Professional and/or Technical Writing); thus, the total percentage of titles and emphasis areas added up to more than 100%.

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Figure 4 presents the breakdown of degree titles and emphasis areas according to disciplinary categories (with Professional and/or Technical Writing listed as its own category).

Disciplinary Categories of Bachelor Degree Titles and Emphasis Areas

- Humanities (humanities, liberal arts, English, journalism)
- STEM (science, engineering, mathematics, information systems)
- Social Sciences (psychology, sociology, political science, linguistics, communication, business/management)
- Professional and/or Technical Writing
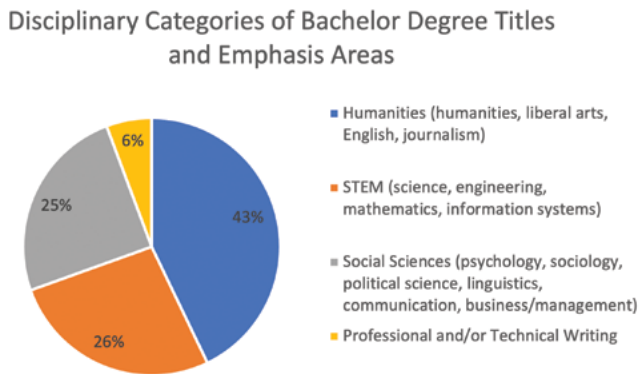
Figure 4. Disciplinary categories of bachelor degree titles and emphasis areas (n=147)

Only 6% of respondents (n=9) listed technical and/or professional writing (TPW) as their degree title or emphasis area. Seven in this count had English or Communication degrees with an emphasis in TPW. Two had full-fledged degrees (meaning required core courses and elective courses focused on various aspects of TPW).

Survey results indicate that most respondents who studied TPW at the college level did so in a graduate program. Of the 79 respondents who had completed a master's degree (43%), 26 listed technical and

professional communication (TPC) as their primary area of study (note the shift from "writing" at the bachelor's level to "communication" at the master's level). This means that roughly 14% of the technical communicators who completed the survey (n=187) had studied TPC at the graduate level (we did not ask those who had completed PhDs to list degree titles or areas of emphasis). It was not clear if the 9 respondents who focused on TPW in their bachelor's program had completed masters' degrees and, if so, what they had studied.

Of the 40 respondents who had completed a professional or academic certificate (22%), half had completed certificates in TPC.

These numbers tell us that a good number of respondents were not likely to have been exposed to academic research in TC as undergraduate or graduate students. Those who had completed undergraduate degrees in fields other than TPC may have read research in a required technical writing service course, and we can safely assume that the 14% of respondents who had completed master's degrees in TPC were exposed to a range of research methods and publication venues in the field as graduate students. But most respondents, if they were familiar with academic research in TC, would have likely learned about that research outside of a TPC degree or certificate program.
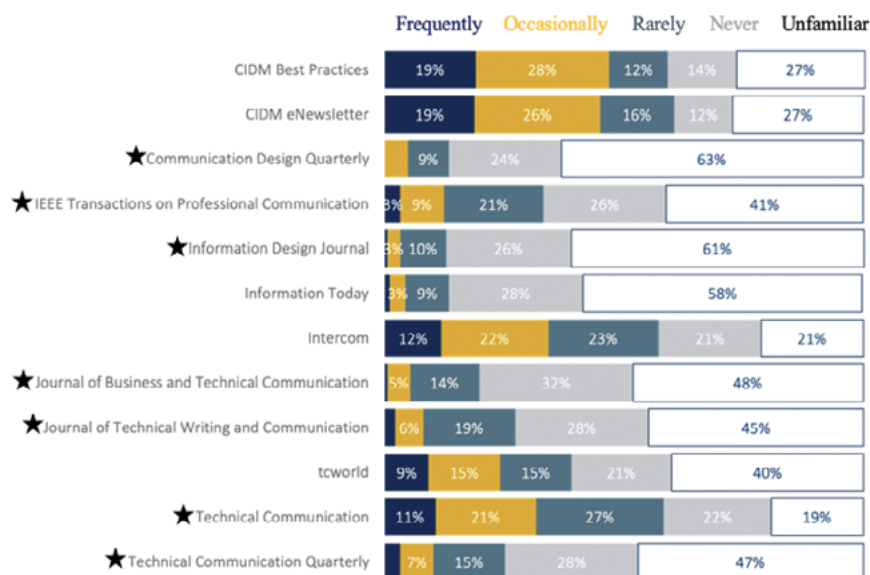
Figure 5. Reading frequency of publications in the field (n=187)

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Experience with and Access to Trade and Scholarly Publications in Technical Communication

In this section of the survey (Questions 6 through 15), we asked respondents to share their experience with reading, authoring, and/or reviewing trade and scholarly publications focused on TC topics.

To determine reading frequency of established publications in the field, we asked respondents to indicate how often they read or skim a particular publication. We listed seven journals (all refereed) and five trade magazines or newsletters. Respondents could select frequently, occasionally, rarely, never, or unfamiliar. Respondents were asked to select "unfamiliar" if they had not heard of a publication. Figure 5 shows reading frequency (refereed journals are starred).

Not surprisingly, trade publications were read more frequently than scholarly publications, with the exception of *Information Today*, an online magazine geared toward professionals in the information industry (not specific to TC). Because we recruited participants from the CIDM mailing list and 11 TC-focused LinkedIn groups, including the STC LinkedIn group, we were also not surprised to see that 47% of respondents frequently or occasionally read the *CIDM Best Practices* newsletter (available to CIDM members),

45% the *CIDM eNewsletter* (free access), and 34% the STC trade magazine, *Intercom* (available to STC members).

We were surprised, however, by the number of respondents who indicated that they were either unfamiliar with or rarely/never read refereed journals in the field. Figure 6 shows a breakdown of how often respondents read or skimmed these publications. We grouped Frequently/Occasionally, Rarely/Never, and Unfamiliar to get a better sense of reading frequency.

The vast majority of respondents were either unfamiliar with or rarely/never read five of the six refereed journals in the field. The journal *Technical Communication* was the exception; 32% of respondents indicated that they frequently or occasionally read the journal, a number that may reflect the number of respondents who indicated that they were STC members (n=56, or 30%). Other organizational memberships included the Institute of Electrical and Electronics Engineers (IEEE) (n=10, or 5%), which publishes *IEEE Transactions on Professional Communication*, and the Association for Computing Machinery (ACM) (including SIGs) (n=8, or 4%), which publishes *Communication Design Quarterly*. Members of these organizations can access their publications for free (non-members must pay a

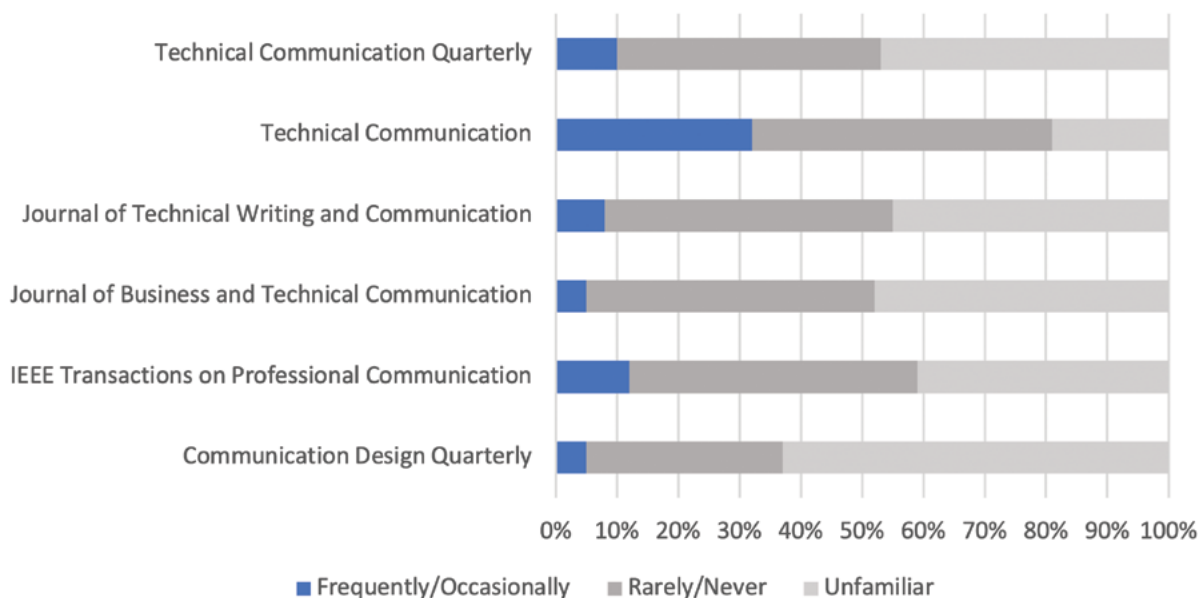### Reading Frequency of Refereed Journals in the Field

Figure 6. Reading frequency of refereed journals in the field (n=187)

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subscription fee or be affiliated with a university to access them). The low percentage of respondents who were members of IEEE or ACM may in part explain the high percentage of respondents who were unfamiliar with or rarely/never read their respective journals.

The *Journal of Business and Technical Communication*, *Journal of Technical Writing and Communication*, and *Technical Communication Quarterly* are accessible via direct subscription (institution or individual) or through university libraries (primarily faculty members and students have access, though some organizations do give access to library holdings); this may be another explanation for reading frequency results. The low percentage of respondents who had completed degrees in TPC may, in part, also explain the number of "unfamiliar" responses.

But we also gave respondents an opportunity to explain their reading frequency selections. Reasons given among the 26 respondents (of 187) who offered an explanation included lack of budget for subscriptions and thus lack of access (n=11), preference for other publications (n=4), lack of relevance (n=3), lack of familiarity (n=3), lack of time (n=3), and poor readability (n=2). Notably, all reasons respondents gave focused on why they selected rarely, never, or unfamiliar. Some did not read because they simply did not have access to or did not know where to find research; others did not read because they did not find the research relevant or they found it too difficult to sift through.

More telling explanations for reading frequency selections came from the final question of our survey (Q25): What is your experience, in general, with academic publishing and/or research? We received 107 responses to this open-ended question: some respondents opted to describe their experience with academic publishing (e.g., as an author of several articles, as a member of a review board) while others opted to describe their basic familiarity with academic research (e.g., "No experience" or "Read some academic articles in college"). Yet others opted to share their experiences as readers of academic research in the field of TC. Of the respondents who commented specifically on their experience as readers (n=44), 5 reported positive experiences and 39 reported negative experiences linked to three frustrations: difficulty finding and gaining access to journal articles, difficulty parsing practical applications, and difficulty making sense of dense and convoluted writing.

Table 2 includes sample responses that capture these frustrations.

Table 2. Experiences with academic publishing and/or research, sample responses

Difficult to Access	Difficult to access (must be known to be found)
	It is hard to find the journals to skim titles, and hard to get into titles even if they look attractive.
	I have been put off reading academic publications by both their linguistic inaccessibility and the fact that one has to pay before starting to read.
Difficult to Apply	It has tended to be more theoretical and hard to apply to a real business environment. If I see a good idea and want to "sell" it to my management or my group, I need some practical points on how I would apply it, the benefits, and very important, what metrics can I use to determine that it resulted in an improvement, added value to my customers, etc.
	Usually it's pretty far removed from practical concerns (or if not, it's so obfuscated with academic language that it's impossible to see the relevance to practical concerns).
	I love reading academic papers. If I know that someone has put hours of hard work doing in-depth investigation, I respect the results. Unfortunately, a lot of publications have very little relevance in the "real world."
Difficult to Read	Too wordy, too lengthy, and too complicated to quickly review.
	The writing is not for professionals. Definitely someone forgot all about needs analysis.
	Time consuming, hard to read, and often not relevant to my current technical communication position.

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In addition to asking respondents about the frequency with which they read trade and scholarly publications in the field, we asked them several questions about authorship. Of the 187 respondents, 33 (18%) had published experience-based or research-based content (e.g., survey results, case study) in a trade publication (e.g., white paper, magazine, newsletter). Of these, most had published a magazine or newsletter article or a blog post.

We also asked respondents if they had published experience-based or research-based content in a scholarly publication (e.g., a refereed book, edited collection, or journal). Only 16 respondents (8.5%) said yes, with 14 indicating that they had published a refereed article and 10 indicating that they had published a chapter in a refereed edited collection (some respondents had authored multiple publications). A higher number of respondents had experience with the academic publishing process through serving as a reviewer for a scholarly publication (n=41, or 22%) or serving on the editorial board of an academic journal (n=11, or 6%). These numbers suggest that about a quarter of respondents (25%) were familiar with the process by which research gets vetted and published in scholarly publications.

Overall, results for this section of the survey indicate that the majority of the 187 respondents, all of whom identified as practicing technical communicators, were either unfamiliar with or rarely/never read

scholarly publications in TC. Those who frequently/occasionally read or rarely/never read research articles tended to find them difficult to access, read, and apply. We speculate that the 25% of respondents who had experience with the academic publishing process as authors, reviewers, or editors likely read research articles with more frequency than those without experience.

Interest Level in Reading Journal Articles Based on Titles and Abstracts

Questions 16 and 17 asked respondents to indicate their level of interest in reading a journal article based on its title or title plus abstract and to explain why they might be interested in reading some articles but not others. We included titles and abstracts in the survey because we knew that many practitioners would not be familiar with academic research and thus we wanted them to react to actual titles and abstracts rather than to assumptions or distant memories that they had about academic research.

Question 16 listed 18 titles of articles published in the most recent issues of six refereed journals in TC (three titles each). Only article titles, not author names or publication titles, were given. Next to each title, we asked respondents to select Very Interested, Somewhat Interested, or Not Interested.

Table 3 includes the titles of articles that respondents (n=171) were most interested and least interested in reading.

Table 3. Level of interest in reading article based on title (n=171)

Very Interested Four titles garnered 50 or more indications of "Very Interested" (five other titles garnered 30 or more)	• Making Memories: Writing and Designing More Memorable Documents (n=74, 43%) • Empathetic User Design: Understanding and Living the Reality of an Audience (n=72, 42%) • Reconsidering Power and Legitimacy in Technical Communication: A Case for Enlarging the Definition of Technical Communicator (n=56, 33%) • The Shape of Problems to Come: Troubleshooting Visibility Problems in Remote Technical Communication (n=54, 32%)
Not Interested Ten titles garnered 100 or more indications of "Not Interested"; we include the four of least interest here	• Using Antenarrative to Uncover Systems of Power in Mid-20th Century Policies on Marriage and Maternity at IBM (n=138, 81%) • Stasis in Space! Viewing Definitional Conflicts Surrounding the James Web Space Telescope Funding Debate (n=132, 77%) • Addressing the Incommensurable: A Research-Based Perspective for Considering Issues of Power and Legitimacy in the Field (n=124, 73%) • Mapping the Contours of Translation: Visualized Un/Certainties in the Ozone Hole Controversy (n=120, 70%)

The four titles of most interest to respondents focused on either improving the user experience or

understanding changing job roles (see Table 4). The articles held the promise of helping readers understand

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how they might improve the user experience through better writing and design or how they might better argue for the value they bring to their organizations. Below is a sampling of comments that represent the most cited reasons why respondents selected "Very Interested" (note: 100 respondents offered comments):

- "Most selected have more of a practical application to the work I do. The remainder are areas of interest but I don't have the time to pursue and, finally, the remainder are way too esoteric."
- "The articles that interest me seem to be written on a subject that would impact my work."
- "I am very interested in articles that address the influence and expanding role of technical communicators. I like to know where I can contribute in that role."
- "I'm interested in articles which help me do my work better and more easily, or which directly contribute to my advancement as a communicator or as a human being. I'm not so interested in articles which are aimed solely at other academics or which appear to be navel-gazing."
- "It's the combination of a subject that interests me with a title that indicates minimal academic jargon. Academics who write about technical communication should make an extra effort to be clear and direct."

The four titles of least interest to respondents did not convey clear practical applications and/or were considered too academic or obscure. Below is a sampling of comments that represent the most cited reasons why respondents selected "Not Interested" (note: 100 respondents offered comments):

- "Some of the titles are so long and full of jargon that I don't hold out much hope for the article to be more engaging than the title."
- "Some [titles] seem too academic and I do not feel like I can learn anything applicable to my role or future roles as tech writer"
- "Most of the titles are dreadfully off-putting, and academic articles are often poorly written with little obvious connection to real-world applications. If the title sounds really pretentious or obscure, I'm not interested."
- "I look for keywords or phrases that I'm interested in: examples in this list would be personas, definition of technical communication, crowd-sourced help. If the title contains words that seem

like academic jargon, I'm almost certain to put the article in the "not interested" pile. Examples: antenarrative, incommensurable."
- "These titles seem too far removed from my daily work experience; sometimes it is difficult to tell from the wording of the title whether the article might be of interest."

Results for Question 17 further pointed to respondents' overall desire for articles that had practical applications and were written in plain language. Question 17 asked respondents to read or skim 18 article abstracts (with titles) from the same six journals (three abstracts each); the abstracts were published in the second most recent issue at that time. After skimming or reading the title and abstract, respondents were asked to select their level of interest in reading the full article: Very Interested, Somewhat Interested, or Not Interested. Only article abstracts, not author names or publication titles, were given.

Figure 7 presents the titles of articles that respondents indicated they would be "Very Interested" in reading after having read or skimmed the article abstract. Six of the 18 articles garnered 40 or more indications of "Very Interested" (n=148); that is, 27% of respondents indicated a strong interest in six articles. Only three of those six were selected by half (50%) or more of all those who responded to the question.

Figure 7. Abstracts garnering 40 or more indications of "Very Interested" (n=148)

What all of the titles and abstracts in Figure 7 have in common is the promise of offering readers a practical takeaway—something that they could take back to their teams and apply to the benefit of their organization or customers. The titles and abstracts also focused on

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topics relevant to respondents' current work practices or projects.

Notably, the abstracts associated with these titles were also well structured with clear headings. "Efficiently Connecting Textual and Visual Information," for example, included the following bolded headings: research problem, research questions, literature review, methodology, and results and conclusions. Readers could quickly skim through the abstract to determine if the topic was of interest. One respondent wrote that she "appreciates chunked, multi-part abstracts" over those presented as "walls of text." Only two of the six journals included in the survey (namely, *Technical Communication* and *IEEE Transactions on Professional Communication*) required authors to write structured abstracts with set headings, and five of the six titles and abstracts represented in Figure 7 are from those two journals. Worth noting here, as well, is that while several respondents appreciated the headings, they did not like the long block of text interrupted by only bold words in *IEEE Transactions on Professional Communication*. The lack of a visual hierarchy and white space discouraged reading.

Titles and abstracts garnering the most "Not Interested" indications were described by respondents as not having any practical application, not being relevant to current work projects, and/or being too academic, esoteric, or difficult to parse. Figure 8 presents a comparison of the title and abstract that received the most "Very Interested" indications to the title and abstract that received the least "Very Interested" indications. Both articles were published in the same issue of *IEEE Transactions on Professional Communication*.

Abstract A describes a qualitative study that addresses two research questions: "(1) How are textual and visual information combined in operating instructions in order to guide the user's attention precisely toward the relevant parts of a household appliance? (2) In what ways can ambiguity arise, and what kinds of strategies can be used to avoid miscommunication and conceptual problems?" The questions suggest to readers that the article will help them to both better understand and improve the user experience. The results and conclusions also point to a research-supported strategy that readers can apply: "We conclude that technical writers need to attend to the links between text and visuals in order to support users

effectively, avoiding ambiguity by purposeful strategies." The title and abstract are further written in plain language (i.e., use of active voice and pronouns to speak to the reader; closeness of subject, verb, and object in independent clauses).

Abstract B, by contrast, presents the results of an experiment focused on the acceptance or rejection of software contract clauses delivered as text or video. Researchers asked, "What are the effects of viewing contract clauses as video clips, compared to viewing clauses as text only, in terms of cognitive effort, communication ambiguity, and correctness in the acceptance or rejection of clauses in software purchasing agreements?" The question suggests to readers that the article will help them understand the effects (or outcomes) of viewing clauses as video clips versus texts, but unlike Abstract A, the question does not imply whether the article will focus on practical applications. The results and conclusions focus solely on the theoretical, leaving practitioner readers without a sense of how the article might be useful: "These findings are consistent with expectations based on Media Naturalness theory, particularly its compensatory adaptation proposition, and inconsistent with expectations based on Media Richness Theory."

While Abstract B certainly focuses on a topic with potential practical applications, the abstract does not point to what these applications might be nor for whom, and the writing overall is much harder to parse than that of Abstract A.

Types of Publications and Content Found Most Useful, Valuable, and Relevant

The next series of questions in the survey asked respondents to indicate the types of publications and content that they have found most useful, valuable, and relevant as practicing technical communicators. We wanted to know what respondents read and why, and we also wanted to know if they would be interested in reading research-based articles on topics of interest and relevance to them. We briefly summarize results of these questions below.

Question 19 asked respondents what types of publications they had found most useful for solving problems and/or improving processes and practices. Figure 9 presents results for the 10 publication types listed (respondents could check all that apply).

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Efficiently Connecting Textual and Visual Information in Operating Instructions

*Abstract—***Research problem:** *Most technical documents rely on a combination of text and visuals to communicate their messages. To achieve the desired effect of improved processing and comprehension of operating instructions, the text must guide readers in a clear way to the relevant visual information in order to avoid ambiguity and misinterpretation, and to ensure that the reader optimally benefits from the available information.* **Research questions:** *(1) How are textual and visual information combined in operating instructions in order to guide the user's attention precisely toward the relevant parts of a household appliance? (2) In what ways can ambiguity arise, and what kinds of strategies can be used to avoid miscommunication and conceptual problems?* **Literature review:** *Operating manuals are usually procedural instructions that tell the user how to set up an appliance, how to operate and maintain it, and how to solve any problems. The vast majority of operating instructions are multimodal in that they include visuals of some kind. But previous research has shown that visual representations of instructions can be just as difficult to interpret as textual instructions—especially if the visuals come without textual elaboration. A combination of text and visuals provides opportunities for taking advantage of both by balancing the other mode's limitations.* **Methodology:** *Our exploratory qualitative study of a small set of operating instructions identifies and classifies types of references to visuals in the documents, enriched by interviews with the technical writers of these manuals. Besides showing patterns of reference types, we examine the potential ambiguity of some types of references along with strategies to avoid communication failure.* **Results and conclusions:** *We identified 10 distinct ways in which links from text to visuals can be established. Line drawings were referred to more than visuals showing display content. The clarity of the link between text and visuals may be affected by the use of spatial expressions (such as left/right) that presuppose an underlying perspective, as well as by the use of semantic and functional information that is not readily accessible to laypersons. Ambiguity can be avoided by using clearly defined labels, specific perceptual information, and by repetition of visual elements in the text. Also, overspecification can be useful for enhancing communication. We conclude that technical writers need to attend to the links between text and visuals in order to support users effectively, avoiding ambiguity by purposeful strategies. Because our study is qualitative and analytic, implications are limited by the scope of our study, and by the lack of empirical user comprehension studies.*

Abstract A
56% (n=84) indicated "Very Interested"

Media Naturalness and Compensatory Adaptation: Counterintuitive Effects on Correct Rejections of Deceitful Contract Clauses

*Abstract—***Research problem:** *Deciding whether to accept or reject contract clauses in software purchasing contracts is a complex communication-related task, which is likely faced daily by a multitude of software purchasing professionals in a variety of organizations.* **Research question:** *What are the effects of viewing contract clauses as video clips, compared to viewing clauses as text only, in terms of cognitive effort, communication ambiguity, and correctness in the acceptance or rejection of clauses in software purchasing contracts?* **Literature review:** *The literature on the Media Richness and Media Naturalness theories suggest that viewing contract clauses as video clips should reduce cognitive effort and communication ambiguity. However, while Media Richness theory suggests that correctness in the acceptance or rejection of clauses in software purchasing contracts should increase with the use of video clips, Media Naturalness theory suggests a neutral overall effect.* **Methodology:** *An experiment was conducted in which student participants were asked to either accept or reject 20 clauses from a software contract, placing themselves in the position of buyers. Of the 20 clauses, 6 were intentionally deceitful and potentially harmful to the buyer. Approximately half of the participants reviewed the contract clauses as web-based text, and the remaining as web-based video clips.* **Results and conclusions:** *Viewing contract clauses as video clips was associated with significantly less cognitive effort and less communication ambiguity than viewing the clauses as text only. Counterintuitively, increases in perceived cognitive effort and communication ambiguity were associated with more successful identification and rejection of deceitful contract clauses. The combination of these competing effects led to an overall neutral effect of the medium on the correctness in the acceptance or rejection of clauses. These findings are consistent with expectations based on Media Naturalness theory, particularly its compensatory adaptation proposition, and inconsistent with expectations based on Media Richness theory.*

Abstract B
9% (n=13) indicated "Very Interested"

Figure 8. Comparison of title/abstract with most and least "Very Interested" indications (n=148)

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Blog posts, conference presentations and proceedings, and online research sites such as usability.gov and plainlanguage.gov were deemed the most useful publications, with trade newsletters/magazines, international standards, and white papers close behind. A good number of respondents also found academic books (n=46, or 32%) and peer-reviewed articles (n=32, or 22%) useful, though explanatory comments indicated that some respondents conflated academic and trade books. In addition to perceived usefulness, the lower numbers for scholarly publications overall likely reflect respondents' lack of familiarity with and access to academic research.

We then asked respondents what type of published content they most valued (Question 20). We wanted to know if they preferred content based on experience (e.g., experience reports that describe a problem or situation and the applied solution) or content based on research (e.g., an empirical study that uses quantitative or qualitative methods to examine a problem or question). Options included content based on experience, content

based on research, I value both types equally, I do not value either type, and don't know.

Respondents largely valued both experience-based and research-based content, as shown in Figure 10.

Figure 10. Type of published content most valued (n=146; 3 responded "Don't Know")
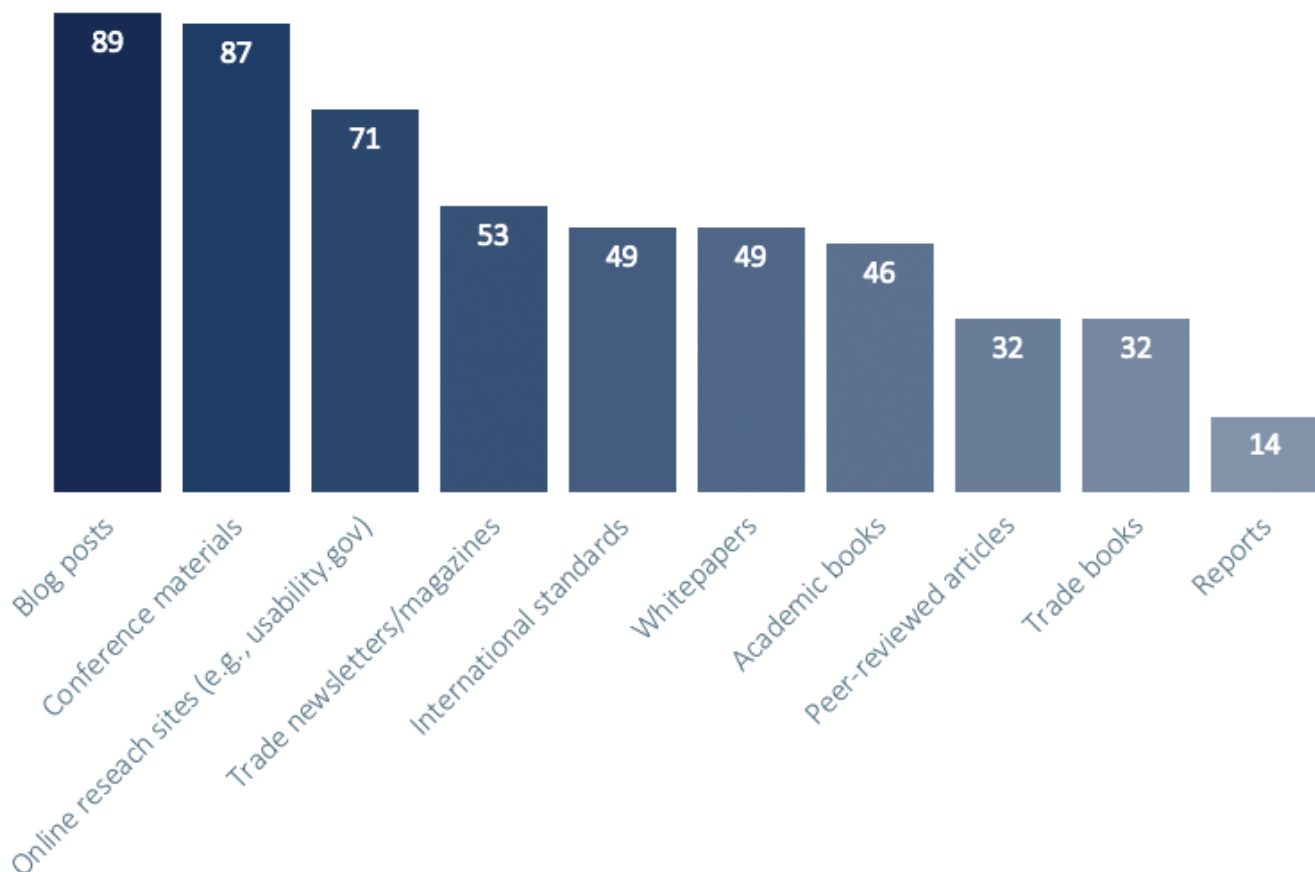
Figure 9. Most useful publications for solving problems and/or improving processes (n=146)

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While only 15 respondents offered explanations for their selection, responses were illuminating. Several respondents emphasized the need for research and experience to co-exist, highlighting the value of insights gleaned from experience and recommendations based on results of a rigorous methodological study. One respondent explained the difference in value added this way: "Research tells you what can work and how, while experience often tells you why it worked or how to adjust in case adjustments are required." Another offered the following response: "To solve a practical problem, experience-based is better. To answer bigger more complex questions, research is usually more trustworthy." Results of this and previous survey questions suggest that practitioners value valid and reliable research data to guide decision making, but they find research that is irrelevant to the questions they need to ask or problems they need to solve of little value.

To determine what kind of research practicing technical communicators would be most interested in reading, we asked a follow-up question: Would you be interested in reading research-based articles (quantitative and qualitative studies, content analysis studies, systematic literature reviews) that examine topics such as content strategy, user behavior, metrics, and processes (e.g., content development, content delivery, technology implementation)? The topics listed were drawn from results of a previous survey that asked participants of the 2012 CIDM Best Practices Conference to list and describe topics for which they would appreciate having research data (Andersen, 2013a).

An overwhelming 89% of respondents (130 of 146) answered "Yes" to being interested in reading research-based articles on these topics. Those who answered "Yes" were then asked to select which topics for research-based articles would be of most interest (they could check all that apply). Figure 11 presents a breakdown of level of interest.

	Number Interested
Content strategy	99
Content development	98
Content management	96
User behavior	91
Content delivery	88
Agile development	73
Metrics	68
Technical communicator roles and competencies	68
Technology implementation	54
Training	50

Figure 11. Research topics of most interest (n=130)

All topics were of interest to some respondents, with topics directly relevant to current information development practices of most interest (those focusing on how best to plan, create, manage, and deliver modular content for reuse and multichannel publishing). The results reflect respondents' overall desire for published research that has readily evident practical applications and relevance to current work practices.

Suggested Changes for How Academic Research is Designed or Reported

At the end of the survey, we offered respondents an opportunity to share suggestions for how academic research in TC might be better designed or reported to increase the relevance, value, and/or accessibility of the research to practicing professionals.

Themes that emerged from our coding of responses (n=99) included a desire for research articles that

- are written in plain language with multiple audiences in mind (n=40),
- focus on topics relevant to current technical communication practice (n=30),
- focus on practical applications of research results (n=20),
- are disseminated through social media and other accessible online venues (n=21), and
- are written in companion, alternative formats emphasizing main points, results, and takeaways (n=16).

Respondents who wanted to see more research relevant to current practices also tended to comment on the

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need for research-based articles to explain how results can be used by practitioners. We saw these themes as related but distinct and thus coded them as such. The same pattern was found in comments calling for research to be easily discoverable (better promoted) and to be structured and formatted in such a way as to allow for quicker distillation of main points, results, and takeaways.

Table 4 presents sample suggested changes that represent the main themes that emerged from our coding of responses.

CONCLUSIONS AND RECOMMENDATIONS

Survey results indicate that practicing technical communicators are interested in academic research that is readily visible and accessible, that is relevant to current work practices, that emphasizes practical applications, and that is easy to read and understand. These results align with those of St.Amant and Meloncon (2016) and Boettger and Friess (2016) and do not necessarily offer new insights into practitioners' experiences with and perspectives on academic research. But they do reinforce the need for authors and journals to do more to reach and engage technical communicators working in the profession.

The majority of our survey respondents were either unfamiliar with or never or rarely read research published in the six main refereed journals in the field. We did not find this result surprising given the low percentage of respondents who had degrees in the field (and thus would likely not have been exposed to TC research in college). Even so, respondents overwhelmingly were interested in knowing about relevant and potentially useful research, and many, through explanatory comments, acknowledged the value of empirical studies over anecdotal stories or experiential reports. Results gleaned from empirical studies can lend credibility and authority to business cases for resources, initiatives, or changes needed to improve processes or solve problems.

It is clear from our survey and series of interviews (see Andersen & Hackos, 2018) as well as from the results of studies published in the November 2016 special issue on "Communication of Research Between Academic and Practicing Professionals" that academic research in the field—in both its design and reporting—has the potential to reach and impact much

wider audiences. In the next sections, we offer ideas for how journals and professional organizations might better promote and increase access to published research and for how authors and journals might increase the relevance, value, and accessibility of practice-oriented research for non-academic readers.

Promotion

Academic research is not well promoted. When a new journal issue or book is published, an announcement is occasionally made on one of the academic listservs, such as the Association of Teachers of Technical Writing or the Council for Programs in Technical and Scientific Communication. Academics in general know to browse the table of contents of journals in the field every few months, as the issues are published quarterly. But journals and book publishers seldom promote issues, individual articles, or books in social media groups or on online platforms frequented by industry readers.

Because academics rely on published research for teaching and for conducting their own research, they are well trained to find and motivated to seek out research on particular topics, either through searches on Google Scholar, university library databases, or journal websites. The model for promoting academic research in TC has tended to rely on a "pull" rather than "push" approach.

What this means is that academic research, particularly new research, may not be on the radar of many practicing technical communicators. And given that many practitioners come from other disciplines and programs of study and thus may not be aware of the field's research journals, they may not know to even look for academic research on particular topics (more than 40% of our respondents were not aware of five of the journals). One of our respondents offered the following comment:

> Honestly, I didn't know how much research-based content was available until I started this survey. We need to spread the word a LOT more. Suddenly, I feel like I've been living under a rock! This is fascinating, important work and should be celebrated and expanded on!

Given that research journals in TC have as a goal to meet the needs of readers working in industry and academia, we encourage journals and other research stakeholders to find more ways to promote articles in

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Table 4. Suggestions for changes in the design or reporting of academic research (n=99)

Plain language for multiple audiences (n=40)	The academic community needs to jettison the notion that complicated wording is more useful than simple and to-the-point wording. I already spend enough time translating complicated technical jargon into plain English. I expect better from technical communicators.
	There is academic writing style and jargon that makes it very unappealing to practitioners.
	Improve language and make content more accessible to non-academics.
Topics relevant to current TC practice (n=30)	Make it as practical as possible. A lot of time it seems academic research is just for discussion between academics. I need to know things relevant to my job. Especially how trends like the quick emergence of the mobile platform affect real world technical writing.
	Finding out what people need, offering solutions, and relating to people on a human level.
	The research has to be relevant to the readers. The issue with academic research is that it's done by academics. So many people in academia are out of touch with the real world.
Practical applications of research results (n=29)	The way that research is reported could better serve the needs of industry professionals by suggesting practical applications of research results. Research-based articles generally talk about future studies, but seldom seem to touch on how their results or findings could be used by practitioners.
	It needs to blend the academic research with practical business outcomes. I need to see a relationship that I can use in my day-to-day activities.
	Academic research should be designed to solve real problems. At least, the outcome of the research should report how the research can be applied to real problems. The outcomes should contain a section on probably benefits and return on investment (ROI).
Dissemination through social media and online venues (n=21)	I'd do it the same way the medical industry does it. Take that research paper and turn it into an article. Post it on social media and everywhere else you can. Do a press release and send it to the Associated Press for distribution. We tech writers need this information to justify why we do things a certain way…. When I can use science as backup to explain why I've organized some information in a particular way, it makes my credibility go up a thousand times. It helps our entire profession and people get a new understanding of what it is that we do.
	In my case, at least, it's mostly ignorance of what's available out there. I don't have much time to poke around the internet finding such research, so if there were a widely publicized central spot for it, I'd be interested.
	More integration with social media types (LinkedIn, Twitter, etc.) would increase the relevance and accessibility to the audiences that are seeking the research.
Companion, alternative formats, (n=16)	Make it available online. Describe the major take-aways up front in a short article that I can quickly read. Provide examples to support them. Provide links to background research so I can do a deep-dive if needed.
	If at least abstracts/summary of results were available in free online publications, the information would be easily accessible.
	Share your findings online, with abstracts written in the style of magazine articles. Plain language, what's the important take-away, what's-in-it-for-me?

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venues frequented by practitioners. The Recent and Relevant column in *Technical Communication* represents one effort to do so. The column, available to STC members in the online version of the journal, provides readers "an efficient way to keep up with technical communication scholarship in a variety of journals that readers might not have time to check individually."

Some preliminary ideas for how journals, authors, and professional organizations can better make research relevant to practitioners more visible are as follows:

- *Publicize new journal issues and articles through social media*. There are dozens of active TC groups on LinkedIn, Twitter, and Facebook, and article titles and abstracts that highlight practical applications are likely to be noticed.
- *Create a social media presence for each journal to allow readers in industry and academia to follow them on different platforms*. When promoting research relevant to practitioners, journals might tag practitioner groups and highlight practical applications of research results. Doing so will bring more traffic to sites on which the journals have a presence and in turn raise the visibility of published research.
- *Promote published research relevant to practitioners at industry conferences.* One survey respondent recommended that conferences set aside a segment of their agenda to focus on results of academic research for the topic of that conference. Titles and abstracts of relevant research articles might also be included in the conference program or in a section of the conference proceedings.
- *Promote published research on existing online repositories*. Example repositories include the STC Technical Communication Body of Knowledge (TCBOK) and the Crowdsource Technical and Professional Communication project spearheaded by Chris Lam of the University of North Texas.

Practitioners, too, can increase their exposure to published research by following the journals on social media and by signing up for new content alerts on the Stay Connected sections of the websites for JBTC, JWTC, and TCQ. Alerts are communicated through email or RSS feeds.

Access

Because access to journal articles requires an individual or institutional subscription to a journal, a membership to a professional organization, or a student or faculty affiliation with a university, many practitioners do not have a way to read the full text of articles of interest. Fewer organizations, as well, have budgets for journal subscriptions or organizational memberships, further limiting practitioners' access to published research in the field. Individual journal articles can be purchased (fees range from $30 to $45), but as our survey findings reveal, the titles and abstracts often do not communicate the value of individual articles to practitioners—and titles and abstracts are the only article content accessible from journal websites and Google Scholar (unless an article has been unlocked allowing full access). If the value of an article is not clear, and if the title and abstract are difficult to parse, practitioners are not likely to want to purchase the article.

In a blog post, Tom Johnson (2010) lamented how inaccessible the field's journals are to practitioners, suggesting that "for a discipline geared towards improving the profession, cloistering up the research makes no sense." We agree, but we also recognize that the for-profit publishing model on which three of the journals operate is not going to change anytime soon, nor is the organizational membership model on which the other three journals operate. Journals additionally must cover publishing, editing, and production costs.

Most TC journals offer authors the option to publish open access, which allows authors to post and share their work free of charge anywhere, anytime, no restrictions. However, this option comes with a steep fee. For example, Taylor and Francis, which publishes *Technical Communication Quarterly*, charges authors an article publishing charge (APC) of $2995.00; likewise, SAGE, which publishes the *Journal of Business and Technical Communication* and the *Journal of Technical Writing and Communication*, charges $3000.00. The vast majority of authors (including their non-profit or for-profit employers) cannot afford this fee and receive no recognition or reward (through performance or promotion and tenure reviews) for paying to make their work accessible to a broader audience.

Making journal articles easier for practitioners to access is a crucial step toward increasing the impact of academic research on TC work in non-academic contexts. To increase access and, by logical extension, readership, journals might consider offering online subscriptions and online access to specific articles at

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as low a price point as possible within their business models. Professional organizations sponsoring journals might also consider offering online subscriptions separate from membership dues, allowing non-members access to journals at an affordable price point. Doing so may raise the profile of research sponsored by the organizations and in turn attract new dues-paying members who are interested in other tangible benefits of membership.

Given our survey findings, we think another good way to increase practitioner access to research is for journals to offer alternative, companion formats for articles of relevance to practitioners. Numerous respondents called for short articles in executive summary format, written in a magazine style, that explain how research results might be applied in particular contexts or to particular problems; they were interested in being able to quickly locate a study and determine its value and relevance for workplace practice. St.Amant and Meloncon (2016) and Boettger and Friess (2016) made similar recommendations based on their research findings.

Offering companion articles would allow journals to better promote articles, reaching a wider audience, and to increase readership—companion articles may also encourage readers to purchase the original article. *Communication Design Quarterly* (CDQ) has recently launched an Abstract Showcase that could serve as a model, though the abstracts are not yet searchable online. Other venues with potential for disseminating companion articles include STC's Notebook blog and the Communication Resources section of the IEEE ProComm website. Journals or professional organizations might also consider sponsoring a research seminar or podcast series. CDQ has also recently launched a podcast "to promote key articles and increase awareness of the publications" (the first episode was released in February 2020).

We envision journal editors inviting authors who publish research on topics relevant to practitioners to write companion articles. However, formal recognition for these important contributions to the field will be essential, as many authors do not publish in venues read by practitioners because academic personnel committees continue to value and reward refereed publications, often dismissing other publication types for having little "impact." Practitioner authors may also benefit from official recognition.

To increase access to academic research, we further suggest that authors consider posting pre-published versions of articles on Academia.edu and ResearchGate. net, social networking sites for sharing research, as well as on open access repositories such as Open DOAR, which lists open access repositories for each university that makes articles by its faculty available to the public. We suggest, as well, that authors in academia post pre-published versions of articles in the open access repository of their university (the UC system, for example, uses eScholarship to support faculty in increasing the reach of their scholarship); these repositories are designed to make research articles authored by faculty available to the public at no charge. Each of the journal publishers allows for authors to post their accepted manuscripts (pre-proof stage) on any websites, repositories, or social media channels.

Relevance and Value

Rude (2009), in mapping the research questions most examined in the field, identified four categories into which research tends to fall. These include disciplinarity (e.g., What are our definitions, history, status, possible future, and research methods?), pedagogy (e.g., What should be the content of our courses and curriculum?), practice (e.g., What design practices are inclusive of international users and users with disabilities?), and social change (e.g., How do texts function as agents of knowledge making, action, and change?). These categories of research remain essential in an ever-evolving and changing field, and the questions that emerge within them continue to require different research approaches (e.g., social, critical, theoretical, empirical).

Regardless of the foci of research or approach taken, however, our survey findings reveal that authors can do more to articulate the value and significance of their research for readers working in both industry and academia. For example, an author might explain how a practitioner can use a theoretical framework to examine or think through a particular problem or situation, or use the results of a content analysis of several websites to inform accessible design considerations for content portals. In the series of interviews that Andersen & Hackos (2018) conducted with practitioners, one interview participant offered the following perspective on what she saw as the value of theoretical research:

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Exposing and illustrating the utility of theoretical frameworks is useful to practitioners and can be used to improve practice or the thinking about practice. The practitioner sourced articles can lean toward superficiality so these theoretical frameworks can help practitioners perform better work and certainly to improve how they communicate what they have observed or learned.

Respondents of our survey offered similar perspectives. They were interested in a variety of research topics and approaches, but they were not interested in reading articles that spoke only to other academics. We want to note, as well, that many respondents did not find brief practitioner takeaways or implications for practice sections useful; in fact, a few mentioned how these sections sometimes seemed like afterthoughts or add-ons. They wanted to see discussions of practical applications connected to actual use cases, and they wanted authors to make applications explicit rather than expecting readers to figure them out.

St.Amant and Meloncon (2016) encouraged authors to ask who they envision as benefactors of their research, how they can best communicate their research to these benefactors, and how their research projects contribute to the larger whole (p. 274). These are important questions given the aims of research journals in the field. The larger whole includes both the profession and the discipline of TC, yet readers in the profession often feel that they are not intended benefactors of published research.

In addition to the suggestions already discussed, we offer the following ideas for how research stakeholders might increase the relevance and value of published research for non-academic readers:

- *All stakeholders.* Encourage researcher-practitioner collaborations, in the design and reporting of research projects. Professional organizations and journals are best equipped to connect academics and practitioners with mutual research interests and provide an infrastructure to support research collaborations (e.g., post call for proposals, create forums for match-making, create awards for articles with measurable impact on practice). Practitioners could propose research questions and studies needed, and academics could help categorize, refine, and consolidate questions and proposed studies. Practitioners might also ask their organizations if they'd be willing to fund a study that promises a clear return on investment.
- *All stakeholders.* Make it easier and more desirable for researchers to conduct studies at work sites and recruit practitioners as subjects (as opposed to students). Several survey respondents noted that studies that only use student subjects are less likely to be convincing and useful. Practitioners can volunteer work sites and provide researchers access, and academic administrators can revise standards for promotion and tenure to recognize the time commitment for conducting work-site research and reward such research in review processes.
- *Journals.* Revise submission guidelines and templates to encourage authors to address the value and significance of their research for both industry and academic readers in article abstracts and introductions. Journals should also provide clear guidelines for writing sections on implications for practice. Editorial boards might consider hosting workshops for authors at conferences on how to articulate the relevance and value of their research for non-academic readers.
- *Journals and practitioners.* Recruit more practitioners to review manuscripts and periodically seek their feedback on the extent to which journals are meeting the needs of industry readers. Practitioners, too, can contact journal editors to express interest in serving as a reviewer; in this role, they can help shape the communication of research and the practical value of results.
- *Academics.* Design studies that address research questions that grow out of practice and feed results back into practice to improve practice, at which point new research questions might be generated. Writing alternative, companion articles that practitioners can easily find, read, and use is one way to feed results into practice.

Writing Style

Better promoting and increasing the accessibility, relevance, and value of academic research for non-academic readers will positively impact these readers' perspectives on and experiences with academic research. However, if published research is a chore to read, most non-academic readers will not take the time to translate it. Long noun strings, excessive nominalizations, academic jargon, six-line sentences, weak sentence

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cores (main idea does not appear in the subject and verb of the independent clause), absence of sentence agents (who is doing what to whom or what) and more are common in research articles. The practicing technical communicators who responded to our survey said overwhelmingly that this abstruse writing style contributed to their negative views of academic research.

An inaccessible writing style is a key reason why practitioners often feel that academic research is not written for them. Tom Johnson (2010), a prominent practitioner voice in the field, spoke to this problem on his blog, "I'd Rather Be Writing":

> I haven't said much about the readability of academic research. Mainly, I find the academic's focus on rhetoric to be one of the great ironies of academia. Rhetoric, so frequently emphasized in academic settings, is the art of fitting the message to the audience. Supposing the academic's audience is the practitioner, does the way academics deliver their information—with academic jargon, endless explanations of methodology, and prose that strips out all sense of humanity—show any principles of rhetoric? Since academics do understand rhetoric, I can only assume they are crafting their message correctly for their audience. That audience is other academics, not practitioners.

While many academic researchers have called for more applied research focused on improving practice and for more collaboration with practitioners in defining research needs and questions (see, e.g., Albers, 2016; Blakeslee & Spilka, 2004; Rude, 2015), few researchers have addressed the need for research to be written in a writing style that is more inclusive of non-academic readers. Yet this was the number one suggested change to how research is reported offered by our survey respondents.

Given that refereed journals in the field aim to be relevant to readers working in both industry and academia, we urge the journals to address writing style in their submission guidelines and to encourage reviewers to provide feedback on writing style in later stages of the review process. The submission guidelines for *Technical Communication* have addressed writing style for some time:

> The purpose of *Technical Communication* is to inform, not impress. Write in a clear, informal

style, avoiding jargon and acronyms. Use the first person and active voice. Avoid language that might be considered sexist, and write with the journal's international audience in mind.

The *Journal of Technical Writing and Communication* also asks authors to "write in clear, concise, coherent prose, using active voice whenever possible." To better enforce writing style expectations, journals might consider expanding on these expectations in submission guidelines, pointing authors to helpful resources, and emphasizing how a clear, accessible writing style can expand the reach and impact of the research.

Two particularly helpful resources that journals might point to include the Federal plain language guidelines, published on plainlanguage.gov, and *The Global English Style Guide* by John R. Kohl (2008). Plain language is a movement for clear communication that emphasizes clear writing, structure, and design. Its rich history spans various business, government, and public sectors, including technical communication activities within those sectors; Schriver (2017) extensively documents this history in her award-winning article, "Plain Language in the US Gains Momentum: 1940-2015." Although plain language has evolved to focus on whole-text communications, on how all aspects of communication design shape findability, comprehension, and usability, it continues to focus as well on clear writing; the Federal plain language guidelines describe numerous strategies for writing clear, concise, and conversational sentences. *The Global English Style Guide*, with its focus on writing texts for global audiences, also offers authors a plethora of strategies for revising sentences, with special attention given to grammatical constructions, terminology issues, and explicit sentence structures. Each strategy is accompanied by explanations and examples. Because some strategies are more appropriate for writing technical documentation than for writing research articles, journals might identify strategies that align with the needs of their global readers and integrate those directly into submission guidelines.

As TC researchers, teachers, and practitioners, we are trained to communicate technical or specialized information to varied audiences for varied purposes—with the goal of helping these audiences easily find, understand, and use the information. Academic research does not need to be an exception. Research articles written in plain language are more likely to

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be read and understood by readers new to the topic, including other academic readers. Research articles written for a global audience will be not only easier to understand by non-native speakers of English but also optimized for translation and machine-translation software, an important consideration given the international reach of the field's journals and their sponsoring organizations. *IEEE Transactions on Professional Communication*, for example, now includes Chinese and Spanish translations of each article abstract. Editor-in-Chief George Hayhoe (2019), in an editorial introducing the addition of the translations, recognized the diverse, global readership of the journal and the benefit of translated abstracts for those who may not be fluent readers of English, also noting efforts of the IEEE Professional Communication Society to make "research in our discipline available to those who need to use it" (p. 1). We hope more journals will take steps in this direction, and one way to do so is to expand submission guidelines to include plain language and global English writing strategies. Journals should encourage if not require authors to apply these strategies, ideally with support from reviewers and editors in the revision process.

We particularly urge journals to encourage authors to write article titles and abstracts in plain language. If authors think of titles and abstracts as promotion pitches for articles and write them with multiple audiences in mind, practitioners looking for research on particular topics will be better able to determine upon a quick read whether or not they want to read the full article (and for some, purchase the article).

Some Final Words

Our study highlights the need for academic researchers and journals to do a better job promoting published research, designing studies that address topics relevant to practitioner readers, and communicating practical applications of research results in clear, accessible language.

Larger conversations among practitioners, academic researchers, administrators, and editorial boards are also needed to better define what kinds of research are valued in the field and for what purposes. Ideally these conversations would lead to a clear articulation of the many ways practice-oriented research contributes to the field's disciplinary identity, language that personnel committees could reference when evaluating a research

profile. This is important because standards for promotion and tenure vary widely across institutions and do not always reflect the kinds of research valued in the field of TC (especially when researchers are situated in departments of English). Conversations need to address how to recognize researchers who publish research that is of measurable value and relevance to practitioners and that is published outside of traditional refereed venues (e.g., in companion, alternative formats or in trade publications).

As Andersen and Hackos (2018) claim, "Without these conversations and a concerted move to change current academic reward structures, researchers may continue to feel discouraged from conducting practice-oriented research and communicating results in a way that is accessible to all readers" (p. 9). Better promoting academic research and requiring research to be written in a clear, accessible style are relatively easy changes that journals can make to better reach their intended audiences. Increasing the relevance and value of academic research for practitioner readers and offering articles in companion, alternative formats are the more challenging changes that will require concerted conversations among stakeholders. Journal editors or editorial boards might consider taking up these conversations in the form of panel conversations or workshops at conferences, with the goal of producing a plan of action for supporting the recommendations offered here. Professional organizations or perhaps a group of senior scholars in the field might take the lead in proposing a special journal issue or edited collection focused on tenure and promotion in technical communication (a publication similar to the 1995 ATTW Anthology, "Issues in Promotion and Tenure: Guidelines and Perspectives"). On the industry side, professional organizations such as STC might examine the feasibility of launching a new research grant program that supports practice-oriented research projects.

Improving the relevance and accessibility of academic research to practitioners is a clear win-win-win situation for academia, industry, and refereed journals in the field, and we urge stakeholders to join us in taking up this important initiative.

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Developing Technical Videos: Genres (or "Templates") for Video Planning, Storyboarding, Scriptwriting, and Production

By Scott A. Mogull

ABSTRACT

Purpose: Technical video production in technical communication courses and practice have become increasingly prevalent with wider access to video equipment, software, and distribution technologies. The goal of this article is to provide a tutorial covering the writing genres used to develop well-planned informative, instructional, or persuasive videos.

Method: The process and genres in this article are developed from a comprehensive literature review as well as eight years of course development teaching advanced undergraduate and graduate courses on "technical video."

Results: In this article, four genres for technical video planning and production are characterized, with examples, for industry practitioners, students, and instructors: video project proposal, storyboard, script, and shot list.

Conclusion: The four-genres used to develop technical videos in industry begins with video project proposal specifying the content, video style, delivery mode of the video, budget, and project timeline. The second step is to create a storyboard, a scene-by-scene sequence of drawings detailing the story or information planned for the video. Next, the process of writing the script develops from the storyboard outline to a more detailed visual and narrated script that emphasizes both the content and style. As covered in the article, video scriptwriting differs from other forms of technical writing—somewhat more similar to an oral presentation rather than print documentation. Furthermore, the narration of technical videos is more complex and often subordinate to the dynamic visual communication (which is, optimally, the primary mode of communicating information to the audience). Finally, the fourth genre to consider is the shot list, which takes the content directly from the script and reorganizes scenes and shots by location for the production staff in order to streamline the filming stage.

Keywords: Technical Video Genres (or "Templates"), Technical Video Project Proposal, Storyboard, Script, Shot List

Practitioner's Takeaway:

- Genres of technical communication are conventionally organized by primary communication goal as informative, instructional, or persuasive. Using these three broad categories of technical communication based on type and style of information, this article identifies and characterizes nine specific categories of technical videos that can be used to plan videos (report/documentary, educational lecture, corporate training, dramatization, interview, stepwise procedure, process overview, proposal, and sales/marketing promotion).

- Technical communicators involved in planning of technical videos are actively involved in the development of written genres used in the video production process. These four genres, in order of development, include: (1) video project proposal (program needs analysis and creative concept), (2) storyboard, (3) script, and (4) shot list. Each of these four genres reflects increasing detail in the verbal and visual communication plan for technical videos.

INTRODUCTION

Technical communication often conveys the dual meaning of communicating specialized content in a technical field as well as communicating through the latest technical media to reach an audience. Yet, the latest communication technology presents increasing demands on technical communication practitioners, students, and instructors to use and master the technical medium with effective communication design so that the message effectively reaches the intended audience. As Northcut and Brumberger (2010) stated, many of us in the field "easily fall under the spell of technology" (p. 463) and succumb to "the myth that media-driven design is an effective production strategy" (p. 465). To some degree, focusing on elements of media-driven design, both content and form, is necessary because (1) such elements provide mechanical foundations for effective communication and (2) new genres are often poorly defined and lack established frameworks for effective communication (Cross, 1994; Dusenberry, Hutter, & Robinson, 2015; Kemnitz, Jeansonne, Kim, Pirie, Shafer, Walker, & Zambon, 1995; Mogull, 2014; Thralls, 1991). However, as stated more bluntly by Ross and Moeller (1996), "Good word processing skills are useful to an author, but they do not define authorship…[Rather,] user-friendly computers and software have made it 'easier to produce *bad* learning materials'" (p. 429). Importantly, authoring effective technical communications in new media requires a holistic approach to communicating visually and effectively using technology by understanding the medium and rhetorical context/situation. Furthermore, the writing and visual communication planning must be integrated in an appropriate style to engage, inform, and, at times, persuade an audience (Hart & Proulx, 2005). In other words, to create *effective* technical communications that are to be delivered through video, technical communicators must not only master the medium technology (equipment and software) but also master communicating in a new writing and primarily visual style and create new, often unfamiliar, genres.

The expanding scope of technical communication includes "technical video," which has undergone some differences in opinion as to the delineation between which videos may fit into the field. Since the vast majority of communication in the 21st century is through digital technologies, the communication technology is less effective for differentiating communications with technical content from other categories of communication (such as entertainment). In this article, the definition of "technical" video refers to content as the subject matter of technical and professional fields, and "video" refers more specifically to the medium so that these terms are clear within this discussion.

For technical video, or technical information delivered through video media, in particular, Gillette (2005) argues that, historically,

> most of us [as technical communicators] would claim no true skill as film makers, and would admit to only an amateur's understanding of the complexities of cinematic presentation—we may know what we like and find enjoyable as audience members (story, character, plot, and scenery) … leaving many of us equipped only with print-informed compositional skills that we can apply to just one small part of the on-screen presentation process. (p. 138)

Similarly, the technical communication literature reports that novice scriptwriters often write "severely flawed" scripts that are not producible within the practical limitations of settings, cast, and other available resources (Connelly, 1995, p. 352). Furthermore, the conventional genres and writing styles of most technical communications do not transfer directly from printed text to the dynamic audial/visual video medium (Bradford, 1987). In a case study by technical writers at IBM, for example, the practitioner-authors (who were trained as traditional technical writers) noted that many technical and professional videos are "poor" communications that are visually dull, poorly produced, poorly cast, and occasionally even a less-effective media format for the content and situation (Dowhal, Bist, Kohlmann, Musker, & Rogers, 1993). Thus, increased attention on "best practices" of communicating through new media are necessary to supplement the evolution of the technology and audience media consumption patterns.

To write effectively for a new communication technology such as technical video, technical communicators—and their instructors—need new genre frameworks that are appropriate for the medium. The goal of this article is to identify and characterize these genres for technical video scriptwriting by

Technical Video Genres ("Templates")

integrating previous literature in the field and from observations of novice scriptwriters in college settings. Specifically, this article contributes to the discussion of video by providing technical communication practitioners, students, and instructors a schema for categorizing technical videos and examples for writing the genres associated with video production in industry.

GENRES FOR DEVELOPING TECHNICAL VIDEOS

This article provides a summary of the written genres for technical video that have been published in the technical communication and corporate video literature. The four genres covered in this article are the key stages contributing to the development of the content and style of videos through the: (1) **video project proposal** (program needs analysis and creative concept), (2) **storyboard**, (3) **script**, and (4) **shot list**. This article provides technical writers with a single source of the written genres that are produced during the creation of a scripted technical video. Notably, this article does not include a discussion of video filming or editing technology as these are production tools (previously compared to word-processing software), which influence, but are distinct from, the conceptual and composition steps of the communication design. Additionally, decoupling technology features and skills from this discussion is useful as software tools are frequently updated and often learned from product documentation and online tutorials. In contrast, the current understanding of the composition and visual communication skills for video are examined here.

Categories of Technical Video

Technical communication genres are conventionally organized by a primary communication goal, such as informative, instructional, or persuasive (Killingsworth & Gilbertson, 1992). Although many communications arguably span multiple categories, this categorization has previously been used as the foundation of a genre taxonomy for technical video scripts and can serve as the foundation for proposing new videos (Kemnitz et al., 1995). From the other side of genre categorization, many articles in the field identify highly conserved genres as particular types of technical videos used in specific situations (such as a brief software demonstration). Through organizing and aligning the categories and named genres from the technical

communication literature, this article identifies nine categories of technical video based on purpose and style of the communication (Table 1). These nine categories of technical video are subcategories of the three primary goals of technical communication, with the presentation format and style of the video being relatively well conserved. Most importantly, these nine categories can then be used to identify the primary goal and communication style used for the planning and development of new technical videos, which benefit from clear differentiation between similar subcategories. However, this categorization should not be used to exclude videos with multiple goals and intentions, especially as one or more vignettes within videos often deviate from the primary presentation style.

For this categorization, live action is not distinguished from animation. Interestingly, such distinction does not in itself introduce a significant difference in the planning, writing, or categorization of many technical videos. Rather, animation tools provide a full range of characters that range from professional, to dramatic, to whimsical (Martin & Martin, 2015). As a result, a documentary-style narrative may be delivered by either a real person or an animated character without any change in the writing style of the technical video script simply because of a different image of the speaker. Similarly, a whimsical style, which may be assumed of animation, might be delivered either through live actors or animation. Thus, live action and animation are an important consideration for the planning and production of a video, yet this distinction does not inherently dictate the style or message of the video.

Genres for Technical Video Content and Style

Technical writers involved in planning the informative content and style of technical videos need to be actively involved in the development of four written genres used in the video production process, which were identified and characterized through an exhaustive literature search of professional and corporate video scriptwriting spanning decades of research. These four genres, in order of development, include: (1) **video project proposal** (program needs analysis and creative concept), (2) **storyboard**, (3) **script**, and (4) **shot list**. Each of these four genres provides increasing detail in the verbal and visual communication plan of a technical video.

Corporate technical videos are near exact execution of the storyboards and scripts. The precise filming

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Table 1. Taxonomy of technical videos categories based on the primary mode of communicating information. Based on the literature in the field, nine categories of technical video are distinguishable by the main goal of the author and primary communication style

Broad Categories of Technical Communication	Categories of Technical Video	Description	Specific Genre Identified/ Characterized in the TC Literature[1]
Informative	Report/ documentary	Narrative explanation of topic in a formal or professional presentation of a topic; often merges speaker narration with viewings of objects or settings	Public service announcement script (Kemnitz et al., 1995) Informative documentary/report on technical communication topic (Mogull, 2014) Characteristics of popular YouTube informative/ instructional videos (ten Hove & van der Meij, 2015) Scriptwriting for communicating reality[2] (Burnham, 1993; Shelton, 1993)
	Educational lecture	Uses classroom teaching as a model for presentation style (somewhat less formal than a report/documentary); visually may be focused on the speaker or slide/ visual board	Speaker presentation (Wiesner, 1993) Computer-based instruction module (Ross & Moeller, 1996) MOOC (Massive Open Online Course) learning video (Santos-Espino, Afonso-Suarez, & Guerra-Artal, 2016)
	Corporate training	Similar to educational lecture but more formal in presentation style. For example, see LinkedIn Learning.	Corporate training lecture (Colby, 1972) Orientation to manufacturing process for corporate training program (Whitney, 1991)
	Dramatization	Scripted situation or interaction between individuals used to demonstrate a situation	Scriptwriting narration to create a natural setting (Carliner, 1987; Williams, 1989)
	Interview	An expert or an affected individual providing insight about the topic	Corporate video magazine covering company news (Cross, 1994)
Instructional	Stepwise procedure	Shows how to perform a task (demonstration)	Instructions for performing a general task (Kemnitz et al., 1995) Instructions for cataloging materials using Digital Librarian software (Casey & Hiett, 1995) Software demonstration (Morain & Swarts, 2012; Swartz, 2012; Alexander, 2013; vad der Meij & vad der Meij, 2013; van der Meij, 2014; Dusenberry, et al., 2015; van der Meij, 2018) Beauty tutorials[2] (Chong, 2018)
	Process overview	Provides orientation or understanding of a process (an overview of a process, which typically lacks all of the steps or details)	Overview of computer system operations (Dowhal et al., 1993) Minimalist Web app videos (Pflugfelder, 2013)
Persuasive	Proposal	Persuades an audience to agree to a particular action or outcome	Proposal in video format (Kemnitz et al., 1995)
	Sales/ marketing promotion	Promotes an item to an audience	Promote attending a specific university (Connelly, 1995) Promote Digital Librarian product at a trade show floor exhibit (Casey & Hiett, 1995)

[1] The technical communication literature is traditionally defined as articles published in five core journals: (*IEEE Transactions on Professional Communication*, *Journal of Business and Technical Communication*, *Journal of Technical Writing and Communication*, *Technical Communication*, and *Technical Communication Quarterly*) (Smith, 2000; Lowry, Humpherys, Malwitz, & Nix, 2007). In addition, articles in two newer journals in the field were included (*Communication Design Quarterly* and *Programmatic Perspectives*). Articles organized by the primary genre covered.

[2] Video content does not directly fit the definition of technical video presented in this article. As stated by Shelton (1993), "Though not directly related to technical communication, this script is an outstanding example of an information film /video script that incorporates strong filmic design elements" (p. 661). In the YouTube Beauty Tutorials article, Chong (2018) provides an insightful rhetorical analysis of popular videos using a "real-ness" (p. 301) instructional style, which provide a contrast to the polished professional videos advocated for more formal contexts Swarts (2012).

Technical Video Genres ("Templates")

of the written content occurs for multiple reasons. First, for technical videos in many industries, the production personnel (directors, camera operators, actors, and graphic designers) are hired for their respective talents and do not have the subject-matter expertise to change or recreate the vision specified by the writer or writing team. Directors in this context are more appropriately considered project managers, who execute the written genres provided by the technical writers. Furthermore, technical videos often require management approval for content, which is based on the written genres, before moving to the expensive and time-consuming production phase. This evaluation also protects technical communicators and organizations from potential legal ramifications that may arise from misrepresentation of individuals or information, or copyright infringement. Thus, any significant change to the content after management approval would be inconsistent with the expectations of management. Finally, the writers of technical videos (typically a group of individuals)—as well as the managers necessary for approval of revised content—are rarely present throughout the filming, animation, sound production, and final editing stages. Therefore, writers of technical video in professional and formal contexts must clearly visualize and thoroughly communicate their vision for the final video as the concept develops through these four written genres for the planning and writing of the audial and visual content.

Video project proposal (program needs analysis and creative concept)

The first written genre often created for technical videos in industry, the video project proposal, specifies the purpose, content, video style, delivery platform, budget, and project timeline (Chu, 2002; Dowhal et al., 1993; Sweetow, 2017). The video project proposal is used within the writing team to reach a consensus for the video project concept and is also often used by management for review and approval prior to further investment in the video development.

While content planning stages are familiar to technical communicators as analogous steps parallel the writing process of technical documents, the stakes for creating technical videos are significantly higher than for written text. From a resource perspective, technical videos in industry range in cost from $1,300 to $10,000+ (*Digital Information World*, 2019). The

lower range of the scale includes in-house (or "DIY") projects with consumer-grade video production equipment, whereas the upper range is the typical cost for outsourced production that includes industry-grade equipment, editing, and personnel (actors/talent, camera operators, and post-production personnel). Although many technical videos are produced on the lower range of the scale, with some conventional steps of filming, editing, and distribution enabled by easy-to-use technology (such as low-cost animation software), investment alone is not the only reason to thoroughly plan the video content. An often-underappreciated dimension of technical video planning is filming *all* the necessary content during a single opportunity (including multiple retakes) to ensure quality footage rather than reworking the concept at the last possible opportunity. Typically, video directors focus on filming multiple retakes of a scene during the same block of time since recreating a scene at a later time with precisely the same visual and audial foreground and background is nearly impossible. The point is that technical communicators planning a technical video—particularly those new to the medium—should invest more upfront effort and time in the rhetorical evaluation and planning genres for the video so that the complex acting and staging can be the focus at the filming stage and all the necessary footage is filmed at each location. Due to the complexity and expense necessary for the filming stage, the planning stages for technical video are more important than for other media (such as print and webpages) because each scene of a video is typically filmed on a single date and the recorded content cannot be easily replicated or changed later. For technical video, the "editing" phase is almost always limited to "cutting and pasting" the filmed video clips together (Spannaus, 2012)—not changing content at the last minute to revise the message of the communication.

For individuals new to planning and writing technical videos, analyzing the strengths and weaknesses of existing videos on the topic (or similar topics) will help to conceptualize different parts of the communication, especially by identifying effective content and presentation styles. As an example, a team of technical writers from IBM who created a technical video for the first time highlighted that they analyzed many technical videos before they began writing—in which they not only evaluated the communication

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style of the audio-visual medium for similar technical content but also, as they stressed, "learned what not to do" as a way to avoid possible mistakes (Dowhal et al., 1993, p. 68). A recommended practice is to find two to three "good" technical videos on a similar topic and then evaluate each technical video, possibly using the list of questions in Figure 1. The purpose of identifying "good" technical videos, in addition to the "bad" ones, is to analyze models of effective communications and have useful examples to guide the visual and verbal/audial elements of the communication.

After evaluating existing technical videos on the topic, the first part of the proposal is to specify the technical content and style of a technical video. An example of the technical content of video project proposal integrates a "program needs analysis" (the goal and content) and includes a plan for the "creative concept" (or style) (DiZazzo, 2004), as provided in Figure 2. In this video project proposal, technical communicators identify the communication goals and rhetorical context (purpose, audience, scope, and communication setting) as well as specify the "creative concept" or the presentation style so that all individuals agree on the direction of the communication before planning the details (Connelly, 1995; DiZazzo, 2004; Floyd, 1987). Of particular note, the planning documentation for technical video includes both the informative and motivational (or affective) objectives of the communication, which are the intended outcome(s) that the video will have on the audience (Connelly, 1995; DiZazzo, 2004).

Depending on the needs and expectations of writers and management, video project proposals may also include a content outline of the entire video (Connelly, 1995; DiZazzo, 2004; Floyd, 1987). Although instructional videos have a relatively standard organization for each genre, a content outline may be particularly useful for determining the ultimate rhetorical effectiveness of the video. As detailed in Figure 3, the conventional structure for an informative video uses a structure similar to an oral presentation (DiZazzo, 2004; Floyd, 1987).

Short and less formal videos may have a simpler structure, a problem-to-solution structure (DiZazzo, 2004), which is the foundation of cinematic storytelling and can be developed from a sentence starting with, "It's about someone who" needs or does the following in a specific context (Leipzig, Weiss, & Goldman, 2016, p. 27). For such dramatizations, writers may substitute a formal outline with a scene-by-scene narrative description of the video, which is called a "treatment" (DiZazzo, 2004; Griese, 1992). Treatments are written as stories in third person and present tense, as if describing each scene of a video as it occurs in real time (Figure 4). Like creative writing, the treatment is filled with affective terms and descriptions of settings, which further enhances learning through affective storytelling in video. Although many technical videos emphasize direct presentation styles, dramatizations may be incorporated into these videos as short vignettes to integrate the information from a realistic situation and encourage contextual learning. Depending on the audience and length of the video, some more complex dramatizations may resemble the prototypical three-act structure of a play, which engage a more general audience but take more time to setup and resolve a plot.

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1. What is the goal or objective of the video?
2. Who is the primary audience? Are there any secondary audiences? (If so, who?) What are the relevant characteristics or features of the audience(s) that influenced design of the communication?
3. In what context will the audience(s) view the video? What is notable about the context that will influence the effectiveness of the video presentation?
4. What should the audience know (or want) at the end of this video? Is the content of the video appropriate for the audience? What information is useful for the audience in this situation? What information is not necessary?
5. Is the style of the video appropriate for the audience and context? Which parts of the video were effective or ineffective? Would a different style or approach be more appropriate or effective? (If so, what one(s)?)
6. Would this technical video be considered a reliable and credible source of information by the audience? What features establish or undermine the credibility of the speaker(s)? What features (apart from the speaker(s)) establish or undermine the credibility of the video?

Figure 1. Questions for evaluating the content and style of existing technical videos. Before planning a technical video, technical communicators should evaluate two to three "good" videos on the topic that were produced by different groups. This evaluation will provide technical content writers with different ideas for planning their own video.

Technical Video Genres ("Templates")

Video Title
Opening a New Savings Account

Problem or Need Statement (Purpose)
New bank tellers at Central Bank need to learn how to open a new savings account for new customers. This video will demonstrate the required steps and the professional style (tone) expected of bank employees.

Target Audience

Primary: New bank tellers who are new employees of Central Bank (may not know information about the savings account or be aware of the Central Bank values)

Secondary:
• Existing bank tellers who need to review opening new accounts (typically because of retraining skills when problems arise)
• Bank managers and training coordinators (for assessment of overall training program)

Objectives
Primary (Determines informative content)
After having viewed the proposed video, bank tellers will know how to:
1. Warmly greet new customers who enter the bank
2. Explain the features of savings accounts at Central Bank
3. Ensure that all new account forms are properly completed
4. Ensure that the customers have all of their questions and needs met

Secondary Objectives (Determines affective and motivational content)
Having viewed the proposed video, bank tellers will also be able to:
1. Learn/observe the proper dress code in model employees
2. Feel confident and excited about helping new customers open savings accounts

Video Style
Primary: Overview of process (live actor narrator, role of bank manager) introduces, summarizes actions, and concludes the video

Secondary: Vignettes breakaway from narrator with dramatization using live actors to show process (new bank teller opening a savings account with new customers at the main branch office)

Primary Viewing Context
Primarily, the video will be shown as part of the first-day orientation of new bank tellers. The video will be displayed on a screen in a small conference room. In some cases, the video will be viewed on a PC or laptop.

Primary Distribution Format/Medium
Upload in MP4 format to Central Bank intranet and steam online.

Figure 2. Communication content for a video project proposal, which includes the Program Needs Analysis & Creative concept for a corporate training video. Adapted from DiZazzo (2004), Connelly (1995), & Burnham (1993)

Storyboard

After the video proposal is reviewed and finalized, the next step for many video projects is to develop a storyboard. A storyboard, similar to a comic book, is a visual, scene-by-scene sequence of drawings outlining the "story" or structure of the video. Often, storyboards are annotated with the key dialogue and major directions for the camera operator and actors to help develop the progression of the video. As emphasized by a professional technical video developer, the storyboard helps technical writers focus on the visual communication as they conceptualize the video. In particular, the video developer stated,

> Film/video scripting is, in fact, visual communication designing—not writing. "Don't write, draw," is an ideal maxim for you to follow in your script-designing endeavors. That is, don't write a script: Draw a storyboard…Thus, the video script is designed rather than written. And by design I mean visual planning that encodes the message to be transmitted into meaningful kinetic visuals with

1. Introduction
    a. Gain audience attention (grabber or "problem")
    b. Relate presentation to job or need, describe payoff or outcome of the video
    c. Provide a list of objectives to set audience expectations
    d. Provide an overview of the main points covered in the video
    e. Transition to first main point
2. First main point
    a. Define or explain the point
    b. Demonstrate or provide an example
    c. Relate to job or need
    d. Reinforce (summarize) critical information about main point
    e. Transition to next point
3. Another main point
4. Another main point
5. Summary
    a. Review of main points
    b. Close presentation

Figure 3. Content outline structure for an informative video uses a structure similar to an oral presentation. Adapted from Floyd (1987)

Video Treatment: "Win the Connection"

Video Treatment
As the scene opens, we are amazed to see Allan Casey, the NuComm vice president known to us all, being hauled into a seedy downtown police station. As Casey is led through a cluttered office booking area in handcuffs, he looks tired and dejected. We see, from a distance, that he appears to be pleading for his release.

In the next scene …

Figure 4. Excerpt of a treatment providing a scene-by-scene description of a corporate video shown at a company meeting (adapted from DiZazzo, 2004). In this excerpt, the corporate video opens with "problem" to be resolved throughout the remainder of the video. For the writing style, treatments are presented as narrative stories in third-person and present tense

sound in only a supporting role. (Shelton, 1993, p. 658)

Visualization, or imagining and creating a visual communication rather than a text-based, narrative communication, is one of the less familiar and challenging steps in the process for those trained in technical writing (Floyd, 1987; Gillette, 2005; Shelton, 1993). Technical writers, as well as students and instructors, are generally more familiar with communicating thoughts through words—often as the primary or sole communication channel—even if not the best channel for the information being communicated (Dowhal et al., 1993; Floyd, 1987; Gillette, 2005). Yet, some trends in visual communication planning are underway in academic institutions. For example, the librarians overseeing new media spaces at the University of Pennsylvania noted significant increases in the popularity of new media assignments (specifically video) to educate and engage the "YouTube Generation" (Vedantham & Hassen, 2011). Thus, increasing numbers of technical communicators in the 21st century are using video to both "show and tell" (Chilcutt & Brooks, 2019, p. 81). Importantly, effective "showing" through the visual communication channel improves audience engagement and retention of the communication, as well as improves the perceived credibility of the speaker (Fish, Mun, & A'Jontue, 2016; Gibson, Hodgetts, & Blackwell, 1990; Saleh, 2011). However, the visual communication elements must be as carefully considered as the written words. For example, in a special section on technical video production in *Technical Communication*, Carliner (1987) noted that, "Beginning scriptwriters often rely too heavily on words or overuse audiovisual gimmicks" (p. 11). Rather than using decorative visuals or media "gimmicks," the most effective technical videos show what can (and should) be shown—and supplement this visual content with contextually appropriate narration that highlights,

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describes, or expands on the main points being shown (Carliner, 1987; Floyd, 1987; Shelton, 1993). As stated by a professional technical video developer, for video,

> Seeing is the key. We are a visual species. Practically all the information we receive every day comes through our eyes—the primary receptor. Sounds play a strictly subordinate role in the reception of information in everyday life for most of us. And

spoken words should play a similar subordinate role in our films. (Shelton, 1993, p. 659)

While considering the images, also consider using various camera angles, camera zoom, superimposed text and graphics, and color to highlight important visual information (Carliner, 1987). Notably, these visual strategies are carefully planned to focus the audience's attention on key content (Table 2). Visual design strategies for refocusing attention should be

Table 2. Use of video camera zoom for audience affect

Camera Shot	Example	Audience Affect
Wide Shot		Situates a scene
Medium Shot		Provides some context while focusing on the important elements of a scene (often a short segment transitioning from wide shot to close up)
Close Up		Used for speakers to show a person with some context; connects a speaker with the audience at a natural distance
Cut Away		Close up on a different part of the scene (not the speaker) to show the reaction of the audience (or emphasize a point, such as a clock showing the passage of time)

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based on the content and clearly defined audience needs rather than loosely defined reasons (such as "for interest") because such vague, nonspecific rationale lacks information-grounded rhetorical intent and may indicate that a dull video concept may be lacking effective visual communication and substituting undefined decorative visuals or "gimmicks" to engage the audience. Such "overuse [of] audiovisual gimmicks" (Carliner, 1987, p. 11) is analogous to the concept of "chartjunk" introduced by Tufte (2001) for visual elements on a graph that were intended to be decorative but are unnecessary—or ineffective—in communicating information to the audience (Few & Edge, 2011).

In addition to visual communication, technical writers must consider the added dimensions of motion and time, which are inherent in the dynamic video medium (Carliner, 1987; Gillette, 2005). The most effective videos are not slideshows of static images (a "montage"), but rather uses the camera to guide the audience's eye and attention through scenes and content (Shelton, 1993). The goal of video is to provide appropriately paced visual content to accompany the narrative, which is developed through the flow of imagery to create a visual "story" in which the main points may be deciphered even without the audio (Shelton, 1993). Often, dynamic visual communication is one of the most challenging aspects for new video scriptwriters trained in print. In one case, a team of technical writers creating a technical video at IBM emphasized that,

> Writers must have visual and aural sensitivity, so that their ideas can be translated into a dynamic (as opposed to static) presentation. Before you actually start to write the script, you should have a structure in place for the entire video [i.e., the storyboard]. (Dowhal et al., 1993, p. 64)

To begin to develop a sense of pacing in storytelling, one of the most effective approaches is to evaluate existing technical videos for the visual composition "storyline" and the pace of information (Gillette, 2005). Then, the dynamic visual narrative is developed in the storyboard, as discussed below.

Creating a storyboard involves visualizing the final video on paper and sketching the relevant visual communication elements necessary in each scene. Individual sketches of each planned shot are organized into panels, which may be placed on a single page (see

Figure 5) or include with additional detail to span several pages (see Figure 6). In Figure 5, for example, the complete storyboard for a visitor registration website is illustrated scene-by-scene through the progression of a comic book-like visual storyline with supplemental notes to guide the narration during the scriptwriting phase. Although this one-page storyboard follows a comic-book format, more detailed storyboard templates (like those in Figure 6) include a summary of narration/dialogue below each pane along with notes that annotate the sketch, such as the major camera angles or actions to explain additional visual elements or actions for the shot.

Notably, storyboarding does not require advanced drawing skills, but rather stick drawings and basic shapes representing objects are sufficient to convey the visual concept from the mind of the author to the filmmaker so that the final scene can be discussed and then created on video (Stoller, 2008). One of the more common obstacles associated with storyboarding is that some novice scriptwriters are overly concerned with the quality of the sketch and, in some cases, try to create a collage of images from online repositories rather than sketch (i.e., create and develop) their own visual plan (Mogull, 2014). As further described, some novice scriptwriters during the storyboarding phase

> spent excessive amounts of time online browsing for available images that related to the content. Often, those [resulting] videos turned into visual collages of stock photos that were loosely tied to the narration and rarely was an effective use of the visual channel. In such cases, the visual channel was essentially "noise" and information was only communicated through narration. (p. 352)

To avoid such obstacles, novice scriptwriters are encouraged to create simple stick drawings on a blank template with only relevant sketches of objects for context (Mogull, 2014). From my experience teaching technical writing students, I have found that many students who integrate images from other sources into storyboards generally lack concrete visual communication planning and had limited relevancy of images that were found from the Web or when using basic storyboarding software with limited options. In contrast, students drawing storyboards by hand were focused more on developing a cohesive, pane-by-pane visual storyline as they conceptualized the video and
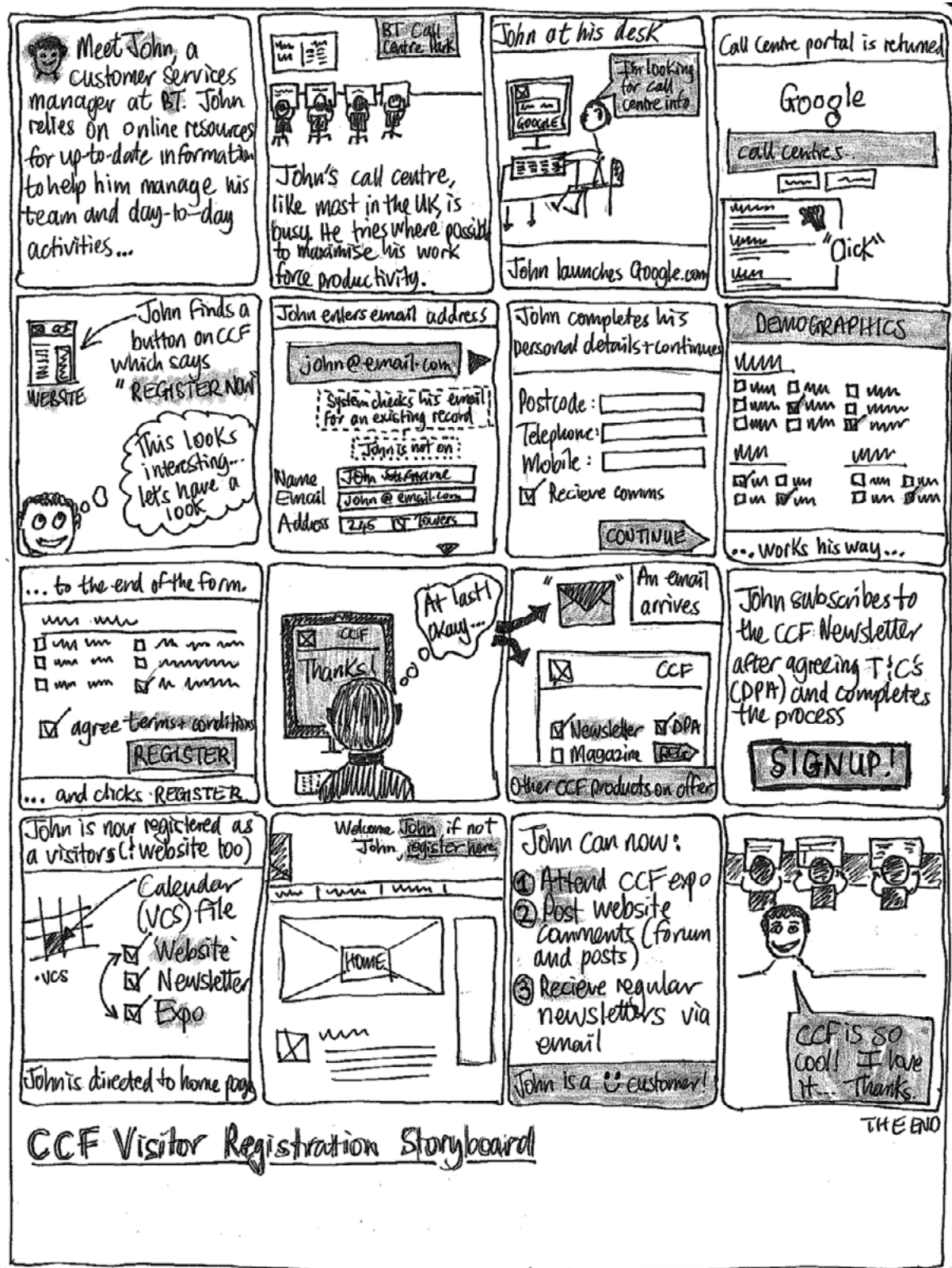
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Figure 5. Example of a storyboard bolstering the visual communication channel of the video medium. CCF storyboard (visitor registration) by Rob Enslin is licensed under CC BY 2.0

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VIDEO: _____

AUDIO: _____

DURATION (IN SECONDS): _____

VIDEO: _____

AUDIO: _____

DURATION (IN SECONDS): _____

Figure 6. Storyboard template for planning technical videos. In this template, the visuals are illustrated in each box with video instructions and audio (narration) detailed below. In contrast to Figure 5, this commonly used template format separates the video and audio channels

were more cognizant of the resources that they will have available for filming the final video. At least anecdotally, hand drawing a storyboard or using a full pallet of options from online storyboarding software seems to help novice scriptwriters plan videos more effectively through the visual communication channel.

The "shot composition," or the collection of the visual panes in the storyboard, ultimately provides the full content of the planned video from the opening title screen to closing frame with the concluding message (Blazer, 2016). The "framing" of each scene focuses on the relevant people, objects, text, and graphics throughout the planned video. The "staging," or the background setting, should also be developed during the storyboarding phase as it provides appropriate context for the presentation or storyline. Typically, the background includes the location(s) and objects that are necessary to effectively situate the video. However, the background setting requires a careful balance to avoid an underdeveloped background (a "dead zone" around

the speakers or objects) or, at the other end of the scale, excessive detail or activity that would compete with the speaker or objects in the foreground and distract the audience from the primary message. By critically assessing the foreground and background of other technical videos, those new to the medium can develop a sense for achieving a balance between the visual message and limiting excess visual noise.

Logistically, the number of frames of a storyboard does not have a preestablished minimum or maximum, but is based on the length of the video and the need to shift the perspective of the camera. Generally, the guideline for adding additional frames to a storyboard is to create a new sketch each time something different is to be shown—a different person, object, camera angle, or setting. However, technical video storyboarding also requires attention to any excessively long camera shot on a speaker, or object, since changing the camera angle or transitioning between speaker and object will help avoid relatively unchanging visual scenes that lack

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any novel visual information. Furthermore, there is not any fixed time length that each sketch translates into video—rather, some scenes will be longer, and some might be very brief. The exact filming time for each panel of the storyboard depends on the content and the audience's need for appropriate pacing of the information. In some cases, the length of the storyboard may indicate whether a video may be visually "dull" (if a storyboard has too few scenes) or too chaotic for the running time (if a storyboard has excessive scenes for the amount of content). For example, a storyboard with 3 sketches and a running time of 10 minutes may suggest a lack visual development whereas 20 sketches for a 30 second video may be visually overwhelming.

Storyboards and scripts are organized into scenes and shots, which are used by filmmakers to plan the filming stage. By definition, a "scene" is any single physical location where a video is filmed. Thus, short videos may have only one setting or scene. On the other hand, "shots" designate each change in the camera location (the viewpoint) or a shift to or from a cutaway image of an object, graphic, or text. For storyboard and script development, both scenes and shots are numbered sequentially based on the final order of viewing, with the renumbering of shots resetting to 1 for each new scene. This numbering system of shots and scenes is important for the final video editing process because filming of videos is typically based on location and camera angle so the actual video is rarely filmed chronologically. Specifically, all shots from a particular camera location (or perspective) are recorded before the cameras, lighting, and sound equipment are moved to capture a different shot. Such repositioning of equipment (and the setup of scenes) is even more laborious when changing physical locations. As a result, the shots and scenes from the storyboard and script are usually reordered immediately prior to filming in the "shot list" to make the video recording phase efficient and consistent with settings and ambient noise. Therefore, after the storyboard is complete, the visual progression through the shots and scenes should be reviewed for continuity of style and spatial orientation to ensure that objects and the settings are consistently positioned and motion follows physical laws (Blazer, 2016; Stoller, 2008). Typically, the storyboard review phase is much like reorganizing an outline in that frames are added, deleted, moved, or changed during the process to finalize the final structure of the video

storyline before moving to the more detailed and laborious phase of scriptwriting.

Script

Once the storyboard is finalized, the process of writing the script is relatively straightforward since the structure or storyline of the video is already established and the writers then focus on the exact wording and visual elements to complete the video plan prior to the filming stage (Floyd, 1987). Notably, the writing style for video—even technical video—is different than other forms of technical writing. From a rhetorical perspective, the video medium serves as an important part of the rhetorical triangle that influences the writing style (Kinneavy, 1971; Gorrell, 1997). In particular, technical writers write the narration or dialogue that is appropriate for the "context" of the video format.

Logistically, the format of a script may be organized into one or two columns. The two-column format is a common and useful organizational tool for technical video scripts in industry because the two-column format clearly distinguishes the video and audio channels (Figure 7), which also helps ensure that scriptwriters are considering both communication channels in parallel. Typically, scriptwriters focus on the speech of actors and off-screen narration (called a voiceover), although video scripts also provide substantially more visual direction than the storyboard (see Table 3) to describe the visual scene, camera direction, speaker vocal emotive inflections, and audio track (music) style. Notably, the visual communication channel develops further alongside development of the narration or dialogue.

As mentioned previously, the narration of technical videos is subordinate to the visual communication (Shelton, 1993). Notably, the style of writing for video (even technical videos) is more colloquial and may not be entirely grammatically correct as sentence fragments and other less formal speaking styles are commonly distributed throughout a video as the audio annotates the visual communication. A useful maxim provided by scriptwriters is to "write for the ear not the eye" (Shelton, 1993, p. 660). In other words, read the narration aloud alongside each visual shot to ensure that both are communicating contextually. More specifically, one of the greatest distinctions between scriptwriting and other forms of technical writing is the style and formality. As Shelton (1993) explains,

SCRIPT: Opening a New Savings Account

SCENE/ SHOT NO.	VIDEO	AUDIO
Scene 1 Shot 1	**INT. CENTRAL BANK, MAIN OFFICE -- DAY** **WIDE SHOT** OF A MALE BANK TELLER SITTING BEHIND A TELLER'S DESK. THERE ARE TWO CHAIRS IN FRONT OF THE DESK. **DISPLAY TITLE SUPER**: OPENING A NEW SAVINGS ACCOUNT AT CENTRAL BANK	BACKGROUND MUSIC – SOFT
Scene 1 Shot 2	**FADE OUT TITLE.** FEMALE BANK MANAGER ENTERS THE SCENE.	BANK MANAGER: In this lesson, you will learn how to open a new savings accounts at Central Bank.
Scene 1 Shot 3	**FADE TO GRAPHIC** – CREATE BULLET LIST ONE ITEM AT A TIME. · Greet new customers · Guide new customers through the forms for creating new savings accounts	BANK MANAGER (**VO**): In this video, you will learn to greet new customers and guide new customers through the forms for creating new savings accounts.
Scene 1 Shot 4	**FADE TO** HIGHLIGHT "Greet new customers" IN YELLOW THEN **FADE OUT.**	BANK MANAGER (**VO**): First, we will cover the process for greeting new customers at Central Bank.
Scene 1 Shot 5	**RETURN TO WIDE SHOT** OF MALE TELLER SITTING BEHIND THE DESK WORKING DILIGENTLY ON A COMPUTER.	
Scene 1 Shot 6	**CUT TO MEDIUM SHOT** OF THE BANK DOOR (**POV** OF THE TELLER) – TWO CUSTOMERS (MALE AND FEMALE, PROFESSIONAL COUPLE) ENTER THE BANK DOOR.	
Scene 1 Shot 7	**RETURN TO MEDIUM SHOT** OF MALE TELLER SITTING BEHIND THE DESK. TELLER LOOKS UP AND THEN STANDS UP.	
Scene 1 Shot 8	**MEDIUM SHOT** (**POV** OF THE CUSTOMERS) – TELLER SMILES AND WALKS FROM AROUND THE TELLER DESK TO THE BANK FOYER. TELLER EXTENDS HAND FOR HANDSHAKE.	TELLER (WARMLY, TO NEW CUSTOMERS): Welcome to Howie's Bank. My name is Kenny Matthews. How may I help you today?
Scene 1 Shot 9	**CUT TO** FEMALE BANK MANAGER NARRATING SCENE.	BANK MANAGER: Notice here that we at Central Bank emphasize personal service. When greeting customers, you should always get up from your desk, walk over to the waiting area, and extend your hand to shake hands.
Scene 1 Shot 10	**MEDIUM SHOT** (**POV** OF THE TELLER) –CUSTOMERS SMILE WARMLY AT THE TELLER, BRIEFLY GLANCE AT EACH OTHER, AND THEN THE FEMALE CUSTOMER TAKES THE LEAD	FEMALE CUSTOMER (TO TELLER): Hi, we're here today because we are new in town and we want to open a new savings account.
	...script continues	

Figure 7. Sample two-column training video script developed from the video project proposal in Figure 2. The two-column script is divided into video and audio channels. Each scene begins with a "slug line," which briefly describes the location and time of day (see Table 3). Capitalization is used for production and actor directions and sentence case is used for dialogue and graphics using sentence case. In this example, scriptwriting terms are presented in bold text (common scriptwriting terms useful for technical videos are provided in Tables 2 and 3). Adapted from Borysowich (2007).

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Table 3. Scriptwriting terms for technical videos

TERM	DEFINITION/USE
Slug Line: Brief description of the location and time of day at the beginning of each scene	
EXT	Exterior (outside) setting
INT	Interior (inside) setting
DAY	During the daytime (daylight)
NIGHT	During the night (nighttime lighting)
Video Shots/Camera Angles[1]	
b.g. (background)	Describe action in the background of a scene
FREEZE FRAME	Video stops moving, becomes still for a period of time
INSERT	Video changes to focus on a different object (typically a shot showing important detail in a scene that must be given the camera's full attention)
MONTAGE	A series of images
PAN	Camera surveys a scene
POV (Point of View)	Shows an object or item from the perspective of a person in the video
REVERSE ANGLE	Camera rotates 180 degrees to get a shot from the opposite angle
SPLIT SCREEN	The frame is split into two, three, or more frames each with a different subject (usually events shown in each section of a split screen are simultaneous actions)
STOCK	Footage from other sources (not to be filmed but rather inserted during the editing phase)
SUPER (abbreviation for superimpose)	Placement of one item over another in the same shot; Often used for TITLES (text) that are superimposed over video actions
ZOOM (IN or OUT)	Camera moves (or lens zooms) in or out
Dialogue/Narration/Audio	
VO (Voice Over)	Speaker (narrator or actor) is off screen (not being shown)
... (Ellipses)	Pause in speaking
-- (Dash)	Change in intonation
Parenthetical identifies verbal style (any style may be specified)	Used to identify the verbal style: NARRATOR (calmly): In the event of a water landing…
MOS: Mit Out Sound (German) or Moment of Silence	No audio
Video Transitions: Video style used to transition from one scene to the next	
CUT TO	Change of a scene from one image to another
FADE TO (or DISSOLVE TO)	As one scene fades out, the next scene fades into place (often used to convey passage of time)
WIPE	One image is pushed off the screen by another image

See Table 2 for standard camera angles.

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Film/video script designing is especially tough for [technical] writers…. Writers write words to be read in some variation of the print medium. And these words are usually read silently and privately. Conversely, designing a video script deals with kinetic visuals to be *seen*, and words and other sounds to be *heard*. (p. 658)

A team of technical writers at IBM agreed, with their recommendation to,

Read it aloud, as the written word and the spoken word are different. We discovered that we modified our audio script as we read it aloud to others at our status meetings. (Dowhal et al., 1993, p. 65)

In general, video is a less formal than print with narration and dialogue written in an appropriate conversational style—the way that people naturally speak to other people in the particular context (Brar & van der Meij, 2017; Griese, 1992; Rhodes, 2018; Shelton, 1993). Video script narration and dialogue should have clear and simple language, short sentences and simple sentence construction, and relatively short descriptions and explanations when compared to print counterparts (Burger, 2015; Rhodes, 2018). In many cases, a final script is not grammatically correct or entirely coherent as a stand-alone, written communication without referring to the visual channel because the audial channel complements the visual communication, which should be the primary communication channel (Shelton, 1993). Several articles mention that most technical video scripts are "overwritten" or, in other words, contain too many words (Carliner, 1987). Professional technical video scriptwriters emphasize that time seems to move more slowly on video, so information should be delivered at a slightly accelerated pace when compared to normal conversation or presentation format (Williams, 1989). As stated by one scriptwriter,

Viewers are impatient. For this reason, it's critical that your video get to the point quickly to keep them engaged. Add to that…distractions. They are constantly competing for your viewer's attention. That's why efficiency in your video is vital—you don't want viewers to lose interest. (Burger, 2015, p. 15)

The number of words of a script is highly variable depending on the content, the use of the visual

communication channel, and needs of the audience. For example, the typical number of words in a public service announcement is approximately double the number of seconds, with a 30 second public service announcement averaging 60 words (Musburger, 2007). Yet, public service announcements may not be the best example for technical content because public service announcements are relatively simple and limited in scope. In contrast, more technical material requires additional information and, at times, a slower pace so that audiences could process the complexity, details, and less familiar information.

Once the content of the script is finalized, scriptwriters review the style and pace of the narration or dialogue by reading the audio channel aloud and evaluating the message with the original goal of the communication. The style of the video script, unlike many printed technical communications, should be more energetic to engage an audience and maintain their attention (Carliner, 1987). An important element of engaging and maintaining attention is to ensure that video scripts efficiently communicate relevant information at an appropriate pace of delivery and, importantly, avoiding including extra information or "fat" that is unnecessary and may result in loosing audience attention (Burger, 2015, p. 15; Carliner, 1987). The writing style of the audial channel, frequently a new style for technical writers, helps the speakers and actors in a video connect with the audience and keep them engaged. As discussed by a scriptwriter who designs and develops corporate training and marketing videos, reviewing the narration and dialogue in a script is essential before moving into the filming and production phases. Specifically, the scriptwriter states,

Many production qualities are more readily visible than the writing: bad acting, poor lighting, choppy editing, continuity problems, and so forth. Very often, though, a poor program started with a poor script. High-budget programs may look good on first appearance, but a confusing (or missing) message can quickly spoil the program. It does not matter how much a weak script is dressed up, it simply will not work. There is an expression in the field of video production: "Well, maybe we can fix it in post" (post-production). To most video professionals, this adage is a joke. It may fool some, but it certainly will not be an award-winning

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program…Good writing creates a good foundation that a production team can build on to produce an effective video program. (Griese, 1992, p. 104)

Thus, technical communicators should review and finalize the script (both the verbal and visual communication elements) before progressing to the production phase (which begins by creating the last genre, the "shot list").

Shot list

The last genre to develop for technical videos is the "shot list," in which writers reorganize the shots and scenes in a script so that they are grouped by location and camera angle to make the filming stage more efficient and consistent (Figure 8). Notably, the shot list is not a genre for developing novel content, but rather is a tool that will be used by the director and production staff during the filming stage as a checklist to collect all necessary content. Filming videos by location is more time (and resource) efficient because it minimizes setup and relocation of production equipment, while ensuring greater consistency both visually and audibly because the setting remains consistent for all "takes" from the same camera angle and with consistent ambient noise levels (Griese, 1992; Stoller, 2008). Although the shot

list and script will be identical in the verbal and visual plan, the shot list may also provide additional logistical information about the locations or setup of scenes so that the director and production staff have all of the information that they need in writing to film the video. The shot list formalizes and solidifies the script by transferring the technical video project from the planning and creation stages to the production phase. In essence, the shot list may be considered the plan, or blueprint, for the production crew to use so that all of the scenes and shots are filmed precisely as intended at each location. A complete shot list, which should be cross-checked by the scriptwriters to ensure that all information is properly transferred, helps ensure that all shots and scenes are setup properly and filmed and that all necessary content will be filmed and available for the video editing phase. For technical video, the editing phase is the phase when the recorded shots are spliced and reordered according to the original script and the final video is prepared for distribution.

CONCLUSION

In this article, four content genres (project proposal, storyboard, script, and shot list) for technical video planning, development, and production are detailed

SHOT LIST 1: Opening a New Savings Account

SCENE/ SHOT NO.	VIDEO	AUDIO
Scene 1 Shot 2	**FADE OUT TITLE.** FEMALE BANK MANAGER ENTERS THE SCENE.	BANK MANAGER: In this lesson, you will learn how to open a new savings accounts at Central Bank.
Scene 1 Shot 3	**FADE TO GRAPHIC** – CREATE BULLET LIST ONE ITEM AT A TIME. · Greet new customers · Guide new customers through the forms for creating new savings accounts	BANK MANAGER (**VO**): In this video, you will learn to greet new customers and guide new customers through the forms for creating new savings accounts.
Scene 1 Shot 4	**FADE TO** HIGHLIGHT "Greet new customers" IN YELLOW THEN **FADE OUT.**	BANK MANAGER (**VO**): First, we will cover the process for greeting new customers at Central Bank.
Scene 1 Shot 9	**CUT TO** FEMALE BANK MANAGER NARRATING SCENE.	BANK MANAGER: Notice here that we at Central Bank emphasize personal service. When greeting customers, you should always get up from your desk, walk over to the waiting area, and extend your hand to shake hands.

Figure 8. Shot list developed from the script. In a shot list, scenes are filmed based on location rather than final sequence of the video. In this example from Figure 9, shot 9 would be filmed immediately after shot 4 so that all video with the bank manager would be filmed at the same time. Creating a shot list helps production personnel film videos more efficiently and helps ensure greater consistency in both the video and audio channels

to serve as a guide for practitioners in industry and as curriculum materials for students and instructors. The primary purpose in describing these genres is to provide those trained for other forms of technical writing to have the vocabulary and a set of templates to use for creating technical videos in industry. This discussion of each genre was supplemented with insights from technical writers in industry who were trained primarily for print and developing technical videos as novice scriptwriters. Furthermore, this tutorial provides the "best practices" collected from the literature for creating technical videos, which have been further annotated with insights that arise from watching novice scriptwriters develop these genres. Notably, this article continues to highlight the primary issue of the overreliance of novice scriptwriters on the verbal "telling" of information in their videos rather than the visual communication, or "showing" of information. In conclusion, technical videos draw from and build on the writing and visual communication skills that are the foundations of the field, but the video medium places additional demands for developing engaging, dynamic visual communications in the new medium.

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The Roles of Medium and Narrative Believability in Guided Mobile Tour Navigation

By Brian C. Britt and Rebecca K. Britt

ABSTRACT

Purpose: This study investigates the role of need for cognition and narrative believability when using a mobile device to take a guided tour of a new location, informing future research and practice in both narrative design and media ecology.

Method: Experiment participants (n = 141) toured a new research facility using one of three combinations of navigation aids (a smartphone only, a brochure and a smartphone, or a brochure only) as a guide. An ordinal regression analysis and multivariate regression analysis were used to assess the relationships among navigation aids, narrative believability, need for cognition, and perceived ease of navigation.

Results: Use of a smartphone only or a brochure in tandem with a smartphone were positively related to evaluations of the narrative as highly consistent as well as perceptions that the narrative offered a high degree of coverage. However, using a brochure in tandem with a smartphone was negatively related to perceived ease of navigation, while narrative plausibility had a positive effect on perceived ease of navigation.

Conclusion: This study illustrates how different mobile devices result in a range of interpretations of the same materials and, ultimately, different levels of success in real-world navigation. Even a simple narrative can aid wayfinding if users find it sufficiently plausible. More broadly, the results suggest the need for research to facilitate the development of more engaging multimedia tour guides.

Keywords: narrative believability, need for cognition, NBS-12, mobile media, guided mobile tour

Practitioner's Takeaway

- Mobile tour guides that emphasize a highly plausible narrative—even a fictional one—may enhance engagement with the tour and help users to more easily navigate the physical space.
- Providing more information or multiple sources of information may enhance appreciation of a narrative but cause users to experience navigational difficulty.
- Self-directed tours should employ a single, well-designed navigation aid rather than multiple devices that only compete with one another for participants' attention.

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The use of mobile technologies to navigate physical locations including museums, cultural exhibits, research facilities and other locales has expanded in recent years (Cho & Park, 2014; Crider & Anderson, 2019; Humphreys & Liao, 2011; Kim, Seo, Yoo, & Ko, 2016; Van Winkle & Lagay, 2012). Often, audio/video tours tell stories in which a virtual narrator leads the way through a narrative, which may be either true or fictionalized, rather than merely providing factual information about the sites being visited and directions to reach subsequent landmarks. Such narratives provide a greater sense of logic and clarity to tour participants' efforts to traverse a given physical location, with the media and their content offering an organizing mechanism for their understanding of the tangible space and their experience in navigating it (see Oppegaard & Grigar, 2014, for a discussion of intermediality connecting media content with the sensations and interactions within the physical space itself). Thus, narratives allow users to understand the physical space on a deeper level and facilitate smoother, more satisfying navigation (Dow et al., 2005; Garau, 2014) as well as a more meaningful experience (Hunter, 2016). Technical communication theories and techniques may help to enhance such experiences, particularly since scholars are already engaging in related tasks, such as generating new theories and applying those theories to the development of software and other tools that serve specific user needs (Conway, Oppegaard, & Hayes, 2020), analyzing the presentation of technical content in web interfaces (Walwema, 2020), and studying the use of language in tour-related signage (Towner, 2019), thus putting technical communication theories directly into practice.

Narrative-based guided mobile tours must address two otherwise unconnected goals. First, they must provide navigational information in a manner that participants can understand, recall, and replicate through their own behaviors in the environment, thus allowing them to traverse the physical space in the intended fashion. In other words, the content of a guided mobile tour must be carefully crafted so that users can apply the information provided therein towards accurate tour navigation (Chen, 2012; Drucker, 2008; Forsberg, Höök, & Svensson, 1998; Häkkilä, Rantakari, Virtanen, Colley, & Cheverst, 2016; Mandelbaum, 2012; Rizvic, 2011; Sun, Tang, Ye, & Zhu, 2015).

Second, the narratives provided in such guided mobile tours must be sufficiently engaging that they maintain tour participants' interest and therefore serve a complementary role rather than detracting from the overarching tour experience. In so doing, the communicative framework of the narrative, as it is situated within appropriately selected media, provides a clear organizing scheme for the guided tour itself. Without such a structure, users could lose interest in the story, become confused, and feel a decline of agency (Dow et al., 2005; Van Winkle & Lagay, 2012). As such, the extent to which users perceive the narrative to be believable is of paramount importance, as a narrative that tour participants do not deem believable may detract from the perceived legitimacy of the tour, distract them from the tour directions rather than augmenting their understanding and engagement, and ultimately inhibit their navigation.

To further understand the influence of narratives on guided mobile tours, we must also account for cognitive factors that may affect navigation and engagement with narratives. Need for cognition (NFC), a commonly used variable in assessing persuasion outcomes from narrative messages (Owen & Riggs, 2012; Rosenbaum & Johnson, 2016), is largely concerned with an individual's tendency to expend cognitive effort. This construct is closely related to the elaboration likelihood model (ELM), as individuals with greater NFC tend to engage with the central route of message processing to a greater degree, focusing more on systematic evaluations of factual information and evidence, than with the peripheral route in which heuristics and general impressions take precedence (Petty & Cacioppo, 1981). In the context of a guided mobile tour, the degree of thought that a user is inclined to devote to the narrative may influence perceptions of its believability. This, in turn, may affect the extent to which the user learns the pattern of behaviors—the directions—necessary to traverse the physical space in the intended sequence (Bandura, 1986), ultimately influencing the navigation experience.

To the authors' knowledge, no prior research has examined the potential relationships between NFC, narrative believability, and perceived ease of navigation in a self-guided tour context. As such, this study assesses the relationships among these three constructs to demonstrate how technical communicators designing tour narratives can apply NFC and narrative

Guided Mobile Tour Navigation

believability to improve tour outcomes. This is particularly relevant as mobile devices are increasingly used, developed, and influenced by technical communicators with careful attention to their content, information, design, and structure. The current study uses an exploratory approach to assess the relationships between NFC, narrative believability, and perceived ease of navigation in the context of a guided mobile tour, thereby illustrating their importance for technical communicators designing tour narratives. More directly, this study demonstrates the potential application of these theories to real-world technical communication in the context of mobile tours, thereby presenting a unique opportunity for practitioners to utilize these theoretical connections in novel ways.

STUDY FRAMEWORK

As the array of personal communication devices has proliferated in recent years, the principles of computer-mediated communication (CMC) have increasingly been applied beyond traditional computers alone (Carr, 2020). Consequently, identifying and utilizing theories in ways that account for the affordances and constraints of different technological devices—that is, the tangible properties of an object that enable or inhibit potential uses—is crucial. To that end, in this exploratory study, we look to the constructs of NFC and narrative believability within the long-established framework of social cognitive theory to inform the theoretical processes and practices of technical communication.

Need for Cognition

Cohen, Stotland, and Wolfe (1955) defined NFC as "a need to structure relevant information in meaningful, integrated ways. It is a need to understand and make reasonable the experiential world" (p. 291). In essence, NFC refers to an individual's general cognitive motivation toward in-depth thought—following the central processing route of the elaboration likelihood model—which itself is related to curiosity and the need to experience situations in meaningful ways. Of course, individuals may bring other intrinsic motivations to tour experiences (e.g., Kim, Ahn, & Chung, 2013, who found that perceived enjoyment—one possible intrinsic motivation—affected intent to use ubiquitous tour information services via a mobile device), but NFC is especially important in narrative-based mobile tour contexts, as individuals who are more motivated

to broadly pursue intellectual stimulation may likewise be more inclined to engage with narratives. A longstanding body of scholarship has found a positive relationship between high levels of NFC, a greater need to evaluate the quality of messages, and the desire to read (Cacioppo, Petty & Morris, 1983; Thompson & Haddock, 2012; Williams-Piehota, Pizarro, Silvera, Mowad, & Salovey, 2006), all of which highlight the wide-ranging importance of NFC throughout one's engagement with a mobile tour.

Social Cognitive Theory

To address the role of navigation in the current study, social cognitive theory (SCT; Bandura, 1986) provides a framework that, alongside NFC, helps to explain behaviors associated with a guided mobile tour. SCT explains learned behavior in terms of environmental factors (physically external factors such as the environment where one is located), individual self-efficacy (the confidence one has in performing a behavior) and reciprocal determinism (the mutual influence between a person's behavior and the environment in which the behavior is enacted). Past research has found a strong relationship between NFC, self-efficacy, and learning in explaining actual outcome success (Elias & Loomis, 2002). In the domain of technical communication, SCT has informed the development of an e-health competency scale to inform health interventions (Britt & Hatten, 2016), and social cognitive effects have likewise been used pedagogically in the design and piloting of technical communication courses for software engineers (Mirel & Olsen, 1998), among other such contributions.

In the context of a guided mobile tour, the elements of SCT are intrinsic to the activity. In simpler terms, the environmental factors that are important for SCT are part and parcel of the tour environment in the sense that there could be no tour in the absence of the environment. A tour participant who perceives oneself to be effectively navigating the tour may consequently build his or her self-efficacy and gain sufficient confidence to enact learned behaviors as the tour progresses (see Bandura, 2009; Christy et al., 2017) such that individual differences between tour participants, narrative structures, and tour delivery mechanisms may impact perceived ease of navigation, which could in turn influence self-efficacy as a potential secondary outcome. Lastly, the act of navigating the

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physical environment via the tour directions, learning more about the physical space and progressing through the tour narrative as a result, is emblematic of the reciprocal determinism that Bandura (1986) describes.

Narratives

Perhaps the preeminent feature of a narrative is its potential for persuasive impact, particularly in the context of a mobile tour where the narrative directly affects real-world beliefs and behaviors because it serves as a navigational aid. Green and Brock (2000), for instance, showed that when a person is absorbed or "transported" into a narrative, that narrative has the capacity to influence the individual's behaviors to more closely align with the story being told. In much the same vein, Busselle and Bilandzic (2008) found that narratives affect phenomenological experiences and subsequent action regardless of whether a narrative is fictional, but violations of external realism and narrative realism that signify a misalignment with external reality or a lack of internal consistency disrupt the construction of mental models to represent and comprehend the narrative, lessening its persuasive power.

At their core, narratives are ubiquitous in human interactions, have existed throughout humankind as a way to experience life, and are thought to be a fundamental part of the self (Bruni & Baceviciute, 2014; Goodson & Gill, 2011). Narratives are a part of daily life; reading books, watching movies, and browsing the Internet are all commonplace examples of narrative engagement, each of which may significantly influence our attitudes and beliefs (Bruni & Baceviciute, 2014; Green & Brock, 2000) with effects that often persist long after initial exposure (Bal & Veltkamp, 2013; Brumi & Baceviciute, 2014). This stands in contrast with, for example, listening to classical music, which lacks a narrative that can influence our beliefs or eventual behaviors.

The Role of Narratives in Navigation

In the context of mobile tours, such narratives, which are carefully crafted to facilitate navigation, have been described as "a vehicle through which the work of the institution gets done" (Burdelski, Kawashima & Yamazaki, 2014, p. 329). In some institutions, such as museums, historical sites, and parks, narratives are often used in face-to-face guided tours or presented on mobile devices as part of a storytelling practice to engage visitors while providing an educational experience (Stephens, 2018).

Navigation, in turn, describes a person's ability to effectively progress from one location to a desired destination (Kawai & Kashihara, 2010). Navigation is itself an active process that is propelled by internal knowledge of one's present location and any external conditions in the given environment (Hunter, 2016). For instance, Bandura (1997) argues that when people observe a set of actions (such as the steps necessary to navigate from an origin point to a destination, whether enacted by a third party or provided as directions from a tour guide), they mentally envision themselves replicating the third party's prior actions and are thus able to perform the same sequence of behaviors themselves or even improvise novel shortcuts (Burles et al., 2020). This is a pattern-oriented approach that influences their subsequent behavior, allowing them to reproduce the steps to which they were exposed even though they were provided with those directions via textual or auditory instructions rather than witnessing their enaction live.

In short, tour participants draw upon the step-by-step instructions provided by others to learn sequences of behaviors that will allow them to effectively navigate the physical space, then enact those behaviors themselves to reinforce their understanding of the environment and how they can traverse it, ultimately translating the directions received as indirect "observations" into navigational proficiency. Although the patterns of behaviors are provided in the form of directions that tour participants must mentally construct rather than firsthand observations that they directly witnessed, the fundamental logic underlying their learning and navigation remains the same as in the original conception of SCT.

Prior research has addressed narration and narrative design in technical communication, although much of this research is dated, such as Barton and Barton's (1988) argument that the importance of narration should be conveyed in the classroom, Blyler's (1996) examination of narrative theory in postmodernist ethnographic research, and Perkins and Blyler's (1999) text addressing the role of narrative in several key communication contexts. These older studies, alongside a few more recent counterparts (e.g., Lemanski, 2014, which mostly explored Web sites and

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other professionally oriented virtual communication), primarily focus on the role of narratives in corporate and pedagogical communication rather than technical communication design itself. As such, the current study provides an essential starting point that connects narrative research with communication design.

In broaching this connection, let us start with the construct of ease of navigation. We may conceptualize ease of navigation as the extent to which an individual is able to progress toward specified destinations without experiencing confusion, uncertainty, or outright navigational errors, which is naturally a core objective of guided mobile tours. For instance, Damala, Cubaud, Bationo, Houlier, and Marchal (2008) developed a mobile tour guide with augmented reality components, and they found that tour participants using the device reported reasonably good ease of navigation despite experiencing significant challenges in handling the device itself. Broadly speaking, the perception that one is effectively navigating a physical space—which we may describe as perceived ease of navigation—could increase those individuals' self-efficacy, helping them to make more confident navigational decisions throughout their engagement with that physical space as well as other unfamiliar venues they may encounter in the future.

With that in mind, mobile devices are popular means to direct tours, using audio, video, and textual information to lead participants through museums, universities, churches, cultural exhibits, and ports, among other locales and events of interest (Cormier, 2009; Sanz-Blas & Buzova, 2016). Studies in navigation and guided tours have explored how mobile devices can aid the navigation process (Cuddihy & Spyridakis, 2012; Laxman, 2011; Sung & Mayer, 2012), although most of the research that refers to "navigation" focuses on the usability of multimedia devices as opposed to successfully traversing a physical space or the perception of doing so. Device usability—that is, the user's ability to work within the affordances and constraints of a device to obtain desired information, move between content sections, and otherwise access material, regardless of any impact beyond the boundaries of the device itself—is certainly important in its own right. However, in the context of a guided mobile tour, usability is best seen as a means to an end, with that end being satisfactory movement through a physical space

between intermediate destinations or toward a desired end location.

In some settings, mobile devices have simply replaced traditional audio tour guides, which typically included a cassette tape or other handheld device that provided recorded spoken commentary. A few tours following this tradition leverage technological affordances to offer additional features—for instance, Kountouris and Sakkopoulos (2018) developed an app that programmatically selects tour stops based on users' individual preferences, thereby providing a customized tour—but the core logic of using the device to simply offer navigational directions and information about each stop remains the same.

Increasingly, however, multimedia tours tell a story, with a pre-recorded virtual tour guide providing a narrative to make the experience more compelling (Zwarun & Hall, 2012; Dow et al., 2005). Such narratives may be invaluable to the tour experience. As Kamarainen, Reilly, Metcalf, Grotzer, and Dede (2018) observed, among other benefits, the affordances of modern communication technologies allow tour designers to incorporate elements such as "creative narratives ... that engage learners in new and unexpected ways" (p. 264). In short, although modern communication technologies present significant constraints that are not exhibited through face-to-face interaction and other modalities (e.g., the absence of sensory cues such as interpersonal physical presence and tactile sensations, the lack of feedback mechanisms that a live tour guide might offer when relying upon static textual or multimedia information, etc.), their capabilities may nonetheless allow technical communicators to design narratives to greatly improve the tour experience.

However, research to date has not explored the impact of the believability of such narratives on an individual's ability to navigate an unfamiliar territory. This is a key gap in the literature, as knowing what specific narrative elements have the greatest impact on navigation would help tour designers to craft more effective, engaging narratives to address their users' needs across myriad user groups and contexts. For instance, if a tour participant deems the narrative highly believable, that may engender a heightened focus on its entertainment and informational elements alike and, consequently, greater success at applying directions to traverse the physical space. At minimum, those who

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are preoccupied with the tour narrative may be less inclined to dwell on navigational failures and perceive their efforts to be more successful. In this way, narrative believability may be intrinsically related to perceived ease of navigation.

Pennington and Hastie (1991) outlined several key components that jointly "determine acceptability of a story, and the resulting level of confidence in the story" (p. 527), representing the overarching construct of narrative believability. These components were initially used in the context of jury trials to assess how believable jurors would deem witness testimony, but they may similarly be applied to a fictional narrative of uncertain veracity presented to tour participants in the hope that they will engage with and commit themselves to the narrative.

The first such component, coverage, refers to "the extent to which the story accounts for evidence presented at trial" (pp. 527-528), or in the case of a guided mobile tour, evidence presented within the narrative that may connect with the physical locations experienced as part of the tour. Next, consistency is "the perception that the facts of a story are not at odds internally or with other information believed…to be true" (Yale, 2013, p. 580). Plausibility, in turn, signifies "the perception that a story is similar to what typically happens in the world" (p. 580), while completeness describes "the extent to which a story conforms to expectations about story structure" (p. 580).

Pennington and Hastie (1991) also described uniqueness as a key element related to juror confidence, as a story that is wildly different from others presented in a jury trial is less likely to be believed, but this does not necessarily describe the believability of a narrative in and of itself—and, as Yale (2013) pointed out, would limit the narrative believability construct to trial contexts alone—so it is excluded from the explication of narrative believability, which instead encompasses narrative coverage, consistency, plausibility, and completeness. Moreover, although all four of these elements are essential for jury trials in which evaluating factuality is essential, this may not be the case for mobile tours and other contexts in which a narrative does not have to be true to be useful. It is possible, for instance, that users may only require the narrative to reach a minimal threshold of believability, or to address a subset of these elements, in order for them to suspend

their disbelief and allow the narrative to augment the wayfinding process.

Considering the prevalence of narratives within mobile tours as well as the potential to strategically craft such narratives to benefit users, it is important to consider the possible relationship between narrative believability and perceived ease of navigation. This is addressed in the following research question:

> **RQ1.** How does the believability of a narrative provided via a mobile device affect a person's perceived ease of navigating a tour in an unfamiliar territory?

Media Ecology
Similarly, if the narrative expressed through a mobile device may affect perceived ease of navigation, it stands to reason that the specific mobile device through which the narrative is communicated may also have an effect, with some devices facilitating navigation more effectively than others. As the core tenets of media ecology theory (Strate, 2004) indicate, the media with which individuals engage provide a conceptual grounding for their experiences across dedicated tasks and, indeed, throughout their day-to-day lives. Other studies demonstrate the importance of navigation aids for users to construct mental maps of their environment—as well as the potential differences between navigation aids using different media—such as Ishikawa, Fujiwara, Imai, and Okabe's (2008) landmark finding that an electronic device "affects the user's wayfinding behavior and spatial understanding differently than do the maps and direct experience" (p. 80).

McLuhan's (1964) classic adage, "the medium is the message" (p. 9), is especially salient in this study, as the particular media used to convey navigational information affect how users perceive, understand, and ultimately apply that information, even if the content itself does not change. More specifically, just as the elements of the narrative itself might influence users' perceived ease of navigation, the media through which the narrative is communicated may exert a similar effect, helping to shape perceptions of users' own navigational experiences. After all, "you can do some things on some media that you cannot do on others" (McLuhan, 2003, p. 271) based on their distinct affordances and constraints—or as Strate (2008) more generally argued, "It is the symbolic form [of a

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message] that is most significant, not the content" (p. 130)—which implies that the same content delivered via different media may affect users in different ways. In particular, as Ong (1967) might suggest based upon the contrast he drew between alphabetic documents and the "sensorium" of electronic communication, media that feature only visual information may be perceived and used differently than multimedia channels providing visual and aural information alike, irrespective of their content.

With that in mind, users of electronic devices with multimedia capabilities may be more readily able to apply navigational directions; alternatively, those relying on a traditional printed document may perceive greater ease of navigation due to the ability to rapidly reference content without grappling with video progress bars and other media elements. Likewise, tour participants using multiple navigation aids may be able to leverage them to compensate for one another's shortcomings such that the users effectively "buttress one medium with another" as McLuhan (2003, p. 271) suggested, or they may instead find that juggling multiple navigation aids is unduly difficult. In short, while it is likely that the mobile devices on which tour participants rely affect their ease of navigation, the specific manifestation of that effect is uncertain. This leads to the following research question:

> **RQ2.** How do different mobile devices used to navigate a tour in an unfamiliar territory affect perceived ease of navigation?

Additionally, narratives are an important resource that can help to satisfy individuals' NFC, with those narratives in turn shaping users' subsequent thoughts and actions. For instance, Owen and Riggs (2012) found that NFC influences narrative transportation, which in turn affects enjoyment of the narrative; Rosenbaum and Johnson (2016) concluded that individuals with higher NFC derived greater enjoyment from narratives whose conclusions had not been "spoiled"; and Zwarun and Hall (2012) showed that, when viewing a narrative, individuals with higher NFC experienced a greater effect on their beliefs and behavioral intentions, with those beliefs and intentions increasingly aligning with those of the narrative.

Given the growing role of multimedia communication today, the question of how individuals immerse themselves in a narrative is critical. In

exploring an unfamiliar physical setting, for instance, some individuals will naturally engage with the experience of a guided mobile tour to a different degree than others. In short, NFC is directly related to some of the underlying cognitive antecedents of successful navigation.

In the current study, participants used a mobile device to navigate from the beginning to the end of a guided tour. As such, a central concern is whether individuals' perceptions of a narrative—in short, narrative believability—is influenced by their NFC, a factor that we would expect to directly impact their information-seeking behaviors. We therefore propose the third research question:

> **RQ3.** How does need for cognition affect perceptions of narrative believability?

In a similar fashion as RQ2, the specific medium through which a narrative is communicated—in other words, the mobile device that an individual is given to assist with navigation—may influence perceptions of the narrative. This prompts the fourth and final research question:

> **RQ4.** How do different mobile devices used to navigate a tour in an unfamiliar territory affect perceptions of narrative believability?

METHODS

Research Design
To properly address how NFC and narrative believability are related to navigation in the context of guided mobile tours, a new research tour was used as a site for study.

The Discovery Park Ubitour was designed to educate visitors about the site's facilities, using a "scavenger hunt" format to guide visitors at the research park, which is open to the public. For instance, throughout the research facilities, there is a diverse array of landmarks that are of interest to both researchers and the general public, including prominent fountains, glass barriers through which visitors can observe lab experiments, paintings, a Lego sculpture, and a café, among other features. The research infrastructure itself is primarily geared toward healthcare delivery, nanotechnology, and biosciences.

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Visitors can take the tour by following printed signs posted throughout each building, which are numbered and marked with QR codes. Those who scan the QR codes with a mobile device can have a pre-recorded narrator provide audiovisual guidance. Alternatively, physical booklets provide the same information.

Materials

One set of materials was created for the tour, which participants were able to view via a mobile device or printed brochure. On the smartphone, the narrative was delivered via a recording of the tour guide. In the brochure, the narrative was delivered as a written transcript. The content shown on the two devices was identical, including the same narrative script and navigational instructions, with the only difference being the presentation format. The materials were created by a research team unaffiliated with the authors for the purposes of providing learning experiences for visitors about the research facilities. The guided tour itself was driven by a simple narrative that was described in the materials as a scavenger hunt, as detailed below. Notably, as suggested by Frith (2015), GPS-based mobile maps were not provided to participants in any of the study conditions, as prior research indicates that such devices are "*too* usable, such that navigators are depending on them to the detriment of their geographic knowledge and orientation skills" (Waters & Winter, 2011, p. 103; see also Ishikawa et al., 2008).

Narrative within the Materials

The narrative within the tour materials was designed to align with the overarching mission of introducing the public to the facilities and educating those visitors about the site, maintaining an appropriate level of sophistication for the laypersons completing the tour. This narrative aligns with and gives meaning to the physical space that tour participants seek to navigate. As a representative example, the fictional narrative was introduced using the following (with identifying information redacted):

> Here's what happened: Back in the second week of my job as a holographic tour guide, I was floating by one of these tables here at the Burton Morgan coffee shop, trying to brainstorm ideas for a memorable tour, when out of the corner of my eye I saw a piece of paper glide under my table. I picked it up, and immediately asked around to find out who might have dropped it. This person was apparently moving fast, because no one around me could tell me much. I hadn't been at Discovery Park long, but I knew enough to realize this insignificant-seeming paper could be a vital link in the chain toward solving an important social problem, such as finding a cure for cancer. So I put the tour brainstorming on hold for the day and decided I needed to play Sherlock Holmes instead. I hadn't been at Discovery Park long, but I knew that important projects went on here. What if this person was working on things that were confidential? So I decided to keep my real mission on the down-low, which meant going undercover. Thankfully my role as a tour guide gave me the perfect excuse to ask lots of questions about projects happening here at Discovery Park. I knew it would be a challenge to come up with the right questions that wouldn't give away my real goal, but I figured I could handle it.

The narrative presented here served two purposes. First, it provided a story to, as Lim and Aylett (2007) put it, "encourage learning so as to create a meaningful tour experience" (p. 1). This introduction described the tour guide's discovery of a lost piece of paper, which he believed to be important to the research facilities. He indicated that he saw somebody drop the piece of paper and decided to "play detective," then invited the tour participant to join him in returning the lost paper to its owner—who might have been engaged with a research project as significant as a cure for cancer, suggesting that returning the piece of paper to its owner could have important implications to which the tour guide (and, vicariously, the tour participant) would have thus contributed.

The playful nature of this introduction meant that it avoided "taking itself too seriously," so to speak, using phrases like "holographic tour guide" to implicitly acknowledge and demonstrate to the viewer that the scenario was fictional. Reducing the apparent gravity of the narrative by clearly portraying it as fictional may have reduced participant anxiety and frustration with any navigational errors made during the tour. Likewise, in the context of the present study, since the fictional nature of the narrative was demonstrated from the beginning, perceptions of its believability could freely vary, as opposed to a nonfiction narrative whose veracity would have been assumed by definition.

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The tour also required the visitor to stop at physical locations by following the tour guide's directions in conjunction with the story. As such, the second purpose of the narrative was to guide the visitor to each stop in the tour. Below is an example of how participants were directed to navigate from one location to the next:

> Head out the doors behind you and to your right (my left) and take the first sidewalk right to the MANN building. There, you'll find marker #4 in front of the paintings of the building's sponsors, and I'll tell you if my investigations bore fruit.

While the narrative was offered in extensive detail to allow participants to immerse themselves within it, the navigational directions were provided in a straightforward fashion to maximize their clarity. In addition, details such as "your right (my left)," which are common in real-world tours to contrast tour participants' perspective with that of the tour guide, tacitly reinforced the believability of the virtual tour guide.

Notably, near the conclusion of the tour, the tour guide recounted returning the lost piece of paper:

> As it turned out, the paper didn't belong to someone who even had an office in Discovery Park, though he had lots of ties with it and was blessedly quite nearby. He was a postdoctoral researcher residing in the biomedical sciences building that you can see to my left, right across from Discovery Park but not in it. He was thrilled to get his task list back, and was kind enough to explain a bit more about his connections to Discovery Park. While he was working on collaborations with researchers in both Bindley and Birck, using, yes, fructose and sucrose. His primary connection had been in the previous two years, when he'd been funded through the Discovery Learning Research Center's fellowships, first to work with local middle-schoolers and then to take a three-week trip to China the next year.

This conclusion appeared to wrap up the overarching story arc, as the tour guide's aim was completed: the piece of paper was returned to its rightful owner. However, the tour participant never gained in-depth information about how the "task list" would be used or what tangible benefits stemmed from the tour guide (and, vicariously, the tour participant)

returning it. Thus, some tour participants may have perceived this as a perfectly suitable conclusion, while others may have found it to be an unsatisfying partial explanation of the outcome, yielding divergent perceptions of the narrative's coverage and completeness. Likewise, while the facts presented within the narrative did not explicitly conflict, the owner of the piece of paper was ultimately found to be a postdoctoral researcher studying nutritional content rather than a scholar seeking a cure for cancer, working with confidential materials, or otherwise engaging in dramatic research whose notoriety would be obvious to lay audiences. Some users may have therefore perceived the conclusion to be inconsistent with the initial assumptions about the owner, so like the other elements of narrative believability, the design of the narrative was such that consistency also could have varied between tour participants.

All told, the narrative elements demonstrated above facilitated sufficient variance in the components of narrative believability to serve the present study while still maintaining a reasonable degree of realism.

Participant Selection

To control for the influences of age, education, and ability to use a mobile device, this study used an undergraduate student sample. Teenagers and young adults are among the biggest groups of users of mobile devices (Pew Internet and American Life Project, 2010) and consequently represent a relatively large portion of overall activity on such devices—hence the targeting of this particular demographic group. Notably, although guided mobile tours have been designed to serve a variety of contexts and demographics (e.g., OnCell, 2020; PocketSights, 2019; Uncubed, 2020), an increasing number are tailored toward undergraduate students as part of class activities and initiatives to familiarize them with college campuses (e.g., GooseChase, 2019, which offers tailored scavenger hunt-based activities and associated licenses for universities and colleges), making this a salient population for an initial examination of these constructs. Thus, upon IRB approval, participants at a large, Midwestern university signed up to be in the study via a university recruitment system, which awarded extra credit towards a course assignment.

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Study Conditions

Participants arrived at a lab located on-site at one of the research facilities at the university and were required to read and complete an IRB-approved consent form. Afterward, they toured the research facilities, guided by one or more mobile devices (smartphone, brochure, or smartphone and brochure) that were randomly assigned to them.

The first two conditions were designed to simulate scenarios in which tour participants are given a single navigation aid. The last condition, in turn, represented cases in which multiple redundant forms of the same content are provided. This does not provide tour participants with additional information, but it may be done in practice to allow participants to triangulate different perspectives on the same information, to select the medium that best fits their personal learning style (e.g., some participants might gravitate toward multimedia content that creates a pseudo-interpersonal connection with the virtual tour guide and facilitates greater personal investment in the narrative, while others might prefer a brochure's affordances that make it easier to rapidly return to key information), or to guard against potential technical difficulties (e.g., if the smartphone fails, the brochure is still usable). As Hirtle (2000) said regarding navigation aids, "redundancy is a positive characteristic, in contrast to other forms of communication where concise, non-redundant communication might be preferred" (p. 34). While such redundancy is generally integrated into a single navigation aid, multiple distinct navigation aids presenting the same information in different ways could potentially achieve the same goal.

Each participant was given the assigned mobile device(s) and directed to complete the tour before returning to the starting point and completing a paper-and-pencil survey.

Demographic data

141 participants completed the tour and associated survey (male = 48.1%, female = 51.2%, declined to disclose = 0.6%). Most participants who self-identified their ethnicities indicated that they were Caucasian (63.6%), with the remainder Asian/Pacific Islander (23.5%), Hispanic/Latino (5.6%), African American (4.9%), or Native American (0.6%). There was a relatively even split among freshman (30.2%), juniors (26.5%), and seniors (27.2%), with sophomores

(15.4%) and one graduate student (0.6%) comprising the remainder of the sample.

Measures

Perceived ease of navigation

The extent to which individuals felt that they were able to easily navigate the physical space in accordance with the tour directions was assessed using a single-item ordinal-level measure, "Overall, how much trouble did you have finding your way from stop to stop?" with response options of "A lot of trouble," "Some trouble," "No trouble," and "I do not know."

Need for cognition: NFC

The need for cognition (NFC) scale, which has previously been observed to be valid (Cacioppo, Petty & Kao, 1984), assesses the tendency to engage and enjoy in cognitive efforts. All 18 items from the original scale were included in the present study and are provided in the Appendix.

Narrative believability: NBS-12

Yale (2013) developed the 12-item Narrative Believability Scale (NBS-12; see Appendix) to measure the extent to which one perceives a narrative to be believable based upon four attributes: its plausibility, completeness, consistency and coverage. In describing the NBS-12, Yale (2013) states that, "It is important to recognize the goal of the instrument is not to measure perceived truth, but rather to measure the various qualities that a seemingly true story has (i.e., its believability)" (p. 4). In other words, the NBS-12 focuses on attitudes about various aspects of a given narrative rather than the simple binary belief about whether or not the narrative is true. Crucially, although the scale was originally developed for the evaluation of legal narratives in court cases, its grounding in attitudes allows it to be used even on narratives that are obviously fictional—such as that of the mobile tour in this study—as this measure effectively assesses whether the narrative is believable enough for an individual to willingly suspend disbelief and treat the story as truthful rather than whether or not the person is merely aware of its inherent truth or falsehood.

Analytic Procedure

To evaluate RQ1-2, an ordinal regression analysis was conducted on the effect of plausibility, completeness, consistency, and coverage, as well as the effect

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of using a smartphone alone or a brochure and smartphone together rather than a brochure alone, on an individual's perceived ease of navigating the tour. Ordinal regression was employed in this case since the dependent variable, perceived ease of navigation, was measured on the ordinal level.

RQ3-4 were assessed using a multivariate regression analysis to determine the effect of an individual's NFC, and whether they used a smartphone or a brochure and smartphone rather than a brochure alone, on the perceived plausibility, completeness, consistency, and coverage of the tour narrative based upon responses to the NBS-12.

All research questions were evaluated using α = .05. Due to the exploratory nature of the two analyses, further steps to control the experimentwise Type I error rate (e.g., Bonferroni correction) would have been inappropriate (see Armstrong, 2014, p. 505; Bender & Lange, 2001, p. 344).

RESULTS

Descriptive Statistics
NFC
The mean and standard deviation for the overall NFC scale in the current study were M = 3.29 and SD = .511, respectively, with a Cronbach's alpha value of α = .698, suggesting borderline reliability for the scale in the present study.

NBS-12
Because the NBS-12 has been largely untested since its initial validation, Cronbach's alpha scores were used to assess the reliability for each of its four subscales within

the current context. The plausibility subscale held α = 0.803 (M = 4.758, SD = 1.236), completeness yielded α = 0.812 (M = 4.002, SD = 1.380), consistency had α = 0.721 (M = 5.009, SD = 0.937), and coverage gave α = 0.777 (M = 4.620, SD = 1.002). All Cronbach's alpha values adhered to the commonly accepted reliability threshold of $\alpha \geq 0.700$ (Nunnally, 1978), indicating that the NBS-12 and its subscales were reliable in the present study.

Research Questions
For RQ1, plausibility (p = 0.007, β = 0.711) was found to play a statistically significant role in the ordinal regression analysis (Table 1), yielding a positive effect on perceived ease of navigation. Completeness (p = 0.115), consistency (p = 0.187), and coverage (p = 0.978) were not statistically significant predictors of perceived ease of navigation.

For RQ2, using a brochure and smartphone in tandem (p = 0.009, β = -2.303) had a negative effect on perceived ease of navigation. On the other hand, no statistically significant difference was found between using a smartphone alone and using another device as a navigation aid (p = 0.220).

For RQ3, NFC was not a statistically significant predictor of any of the four narrative believability components in the multivariate regression analysis (p = 0.102 to 0.776; see Table 2). In addressing RQ4, use of a smartphone alone resulted in heightened perceptions of the tour narrative as being consistent (p = 0.022, SS = 4.372), while participants who used a brochure and smartphone together tended to perceive the tour narrative to have stronger consistency (p = 0.002, SS = 7.874) and coverage (p = 0.023, SS = 5.173) alike.

Table 1. Ordinal regression model for perceived ease of navigation

Predictor	Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Threshold: Ease = 1	-3.736	2.034	3.373	1	.066	-7.724	.251
*Threshold: Ease = 3	4.609	1.915	5.796	1	.016	.857	8.362
*Plausibility	.711	.264	7.250	1	.007	.193	1.229
Completeness	-.396	.251	2.482	1	.115	-.888	.097
Consistency	-.598	.453	1.744	1	.187	-1.485	.289
Coverage	-.011	.401	.001	1	.978	-.797	.775
Smartphone	1.485	1.211	1.505	1	.220	-.888	3.859
*Brochure/Smartphone	-2.303	.880	6.845	1	.009	-4.028	-.578

*Denotes statistically significant effects with α=.05
Cox and Snell pseudo-R^2 = 0.242

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As shown in Table 3, subjects in the brochure and smartphone condition had the highest group mean for all four narrative believability components (plausibility: brochure and smartphone condition = 4.7849, other conditions = 4.6381 to 4.7500; completeness: brochure and smartphone condition = 4.1667, other conditions = 3.6571 to 4.0303; consistency: brochure and smartphone condition = 5.2204, other conditions = 4.6571 to 5.1061; coverage: brochure and smartphone condition = 4.8011, other conditions = 4.3238

Table 2. Multivariate regression model for narrative believability

Source	DV	Type III SS	df	Mean Square	F	Sig.
Corrected Model	[a]Plausibility	4.017	3	1.339	.864	.462
	[b]Completeness	7.093	3	2.364	1.237	.299
	*[c]Consistency	9.551	3	3.184	3.892	.010
	[d]Coverage	5.203	3	1.734	1.764	.157
Intercept	Plausibility	5.479	1	5.479	3.534	.062
	Completeness	6.356	1	6.356	3.325	.070
	*Consistency	9.477	1	9.477	11.586	.001
	*Coverage	14.978	1	14.978	15.234	< .001
NFC	Plausibility	3.524	1	3.524	2.273	.134
	Completeness	1.217	1	1.217	.637	.426
	Consistency	2.214	1	2.214	2.706	.102
	Coverage	.080	1	.080	.081	.776
Smartphone	Plausibility	.406	1	.406	.262	.610
	Completeness	2.985	1	2.985	1.561	.214
	*Consistency	4.372	1	4.372	5.345	.022
	Coverage	1.515	1	1.515	1.541	.217
Brochure/Smartphone	Plausibility	.789	1	.789	.509	.477
	Completeness	6.314	1	6.314	3.303	.071
	*Consistency	7.874	1	7.874	9.627	.002
	*Coverage	5.173	1	5.173	5.262	.023
Error	Plausibility	212.385	137	1.550		
	Completeness	261.906	137	1.912		
	Consistency	112.054	137	.818		
	Coverage	134.704	137	.983		
Total	Plausibility	3381.111	141			
	Completeness	2522.333	141			
	Consistency	3710.222	141			
	Coverage	3148.667	141			

Denotes statistically significant effects with α=.05
[a]$R^2 = .019$, Adjusted $R^2 = -.003$
[b]$R^2 = .026$, Adjusted $R^2 = .005$
[c]$R^2 = .079$, Adjusted $R^2 = .058$
[d]$R^2 = .037$, Adjusted $R^2 = .016$

Table 3. Group means for narrative believability

Condition	Plausibility	Completeness	Consistency	Coverage
Brochure and Smartphone	4.7849	4.1667	5.2204	4.8011
Smartphone	4.7500	4.0303	5.1061	4.5985
Brochure	4.6381	3.6571	4.6571	4.3238

to 4.5985), while the smartphone-only condition exhibited a mean consistency rating (5.1061) that was far closer to that for the brochure and smartphone condition (5.2204) than the brochure-only condition (4.6571).

DISCUSSION

This study served the key purpose of examining the role of narrative believability and NFC in the context of a guided mobile tour. The NBS-12 was used to assess narrative believability for purposes outside the context for which it was originally developed, which included implications for persuasion and juror decision making processes (Yale, 2013). This was an ideal scale for the current study due to its subscales that assessed plausibility, completeness, consistency, and coverage. These factors are crucial to assessing the believability or persuasiveness of a narrative, which, in the context of a guided mobile tour, shared important theoretical linkages with perceived ease of navigation, particularly since narratives have been found to be important resources for individuals who tend to be stimulated by deeper thought processes (e.g., Rosenbaum & Johnson, 2016; Zwarun & Hall, 2012).

With that in mind, the present manuscript replicated the moderate reliability for the subscales of the NBS-12 despite its use with an entirely different population within a new set of circumstances. It is useful to observe the effectiveness of this measure beyond merely predicting the outcomes of legal proceedings, as this helps to indicate its broader utility as a scale for the construct of interest: narrative believability.

While the plausibility of the narrative was significantly related to perceived ease of navigation as assessed via RQ1, the other NBS-12 subscales of completeness, consistency, and coverage were not significant predictors. This indicates, rather curiously, that the extent to which the story in the narrative was perceived as being complete in its own right, its

apparent internal consistency, and the degree to which it fully covered the topic at hand had no discernible effect on perceived ease of navigation. This defies conventional wisdom that "more information is better," suggesting that navigation aids may be better used to highlight key points and allowing users to fill in the gaps between them rather than to paint an absolutely comprehensive or even internally consistent story related to their surroundings.

It should be noted that the detective-like narrative framework used in this study was not particularly novel in nature, with little aside from the "holographic" nature of the tour guide setting this narrative apart from other scavenger hunt scenarios. One might even argue that this narrative was childish, featuring a simplistic narrative thread without significant plot twists to captivate the user. Yet as this study demonstrates, even a generic narrative can motivate people to learn. This is especially true if the narrative, regardless of its sophistication or lack thereof, is deemed plausible—after all, innovative narrative constructs and compelling plot twists are not essential for users to conclude that "this could happen"—as a plausible narrative provides a meaningful cognitive foundation around which users' engagement with navigational directions may be structured. In short, although this study did not demonstrate that narrative completeness, consistency, or coverage influenced ease of navigation, the effect of plausibility was statistically significant; as such, technical communicators developing navigation aids should prioritize the plausibility of those narratives, even if the storylines they convey are otherwise simplistic.

Different mobile devices resulted in statistically significant effects on perceived ease of navigation and narrative believability, as assessed via RQ2 and RQ4. Specifically, users engaging with the tour narrative via a smartphone alone perceived it to have greater consistency than participants using other navigation aids did. On the other hand, those who were given both a brochure and smartphone reported more difficulty

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with navigation than their peers, yet they perceived the combination of aids to offer even greater consistency and coverage relative than a single navigation aid.

This latter result is especially interesting, as it demonstrates that allowing users to employ multiple navigation aids that compensate for one another's weaknesses or can otherwise be triangulated may enhance their appreciation of the narrative, but they suffered greater perceived navigational difficulties as a consequence, so this is not necessarily a viable strategy for improving guided mobile tours. On the contrary, participants who sought to juggle multiple navigation aids tended to struggle as a result, suggesting that more is not necessarily better.

These two consequences of a multiplicity of media ought to be carefully considered. There are significant benefits therein, particularly to enhance narrative engagement on the part of users. In other words, the medium used to communicate a narrative matters, and seemingly redundant media conveying exactly the same information may improve perceptions that the narrative is stable. Yet when those media are meant to be used as aids to perform an external task, compelling users to employ multiple media in tandem may do more harm than good. As for the design of self-directed tours themselves, the lesson is, simply put, that they should employ a single, well-designed navigation aid rather than multiple devices that only compete with one another for participants' attention.

Earlier research in medium studies suggested that the affordances and constraints of text-oriented, asynchronous attributes in technologies are central attributes (Sproull & Kiesler, 1991); likewise, more recent studies of new media have continued to emphasize the importance of affordances and constraints in communicating information (de Graaf & Meijer, 2019; Meijer, 2008). As this discipline has increasingly highlighted the roles of affordances and constraints, the physical attributes of the brochure and mobile device should be considered in this context. For instance, regarding narrative believability, users employing the brochure and mobile device in tandem deemed the narrative to have greater consistency and coverage than other users engaging with only a single device, yet they reported comparatively worse ease of navigation. The fact that the narrative was available in an asynchronous format in both the brochure and mobile device in a handheld, tangible format may have

allowed users to easily cross-reference the two sources and verify that the content was replicated across both sources, increasing perceptions of its reliability and suggesting that the narrative held greater consistency and coverage as a result. In other words, although the content across the two media was wholly redundant, the replication may have lent greater weight to the content in the minds of users.

Finally, as discussed in conjunction with RQ3, the NFC exhibited by tour participants did not have a statistically significant effect on their evaluations of the narrative. This suggests that attempts to satisfy tour participants' NFC within a guided mobile tour narrative may ultimately be inconsequential, yielding minimal effect on the overall tour experience.

More broadly, it is noteworthy that the ordinal regression model of perceived ease of navigation yielded pseudo-R^2 = 0.242, so the predictors explored in this study explained roughly a quarter of the variance in perceived ease of navigation. A great deal of the variance remains unexplained, implying the need for further research into perceived ease of navigation.

These results suggest possible limitations in current multimedia tools used to deliver mobile tours. They also further beg the question: how can we make video tours more engaging without relying on multiple navigation aids and potentially sacrificing navigational efficacy? Future studies and interventions should consider how to use theory to drive the design of and fully engage in the use of mobile technologies to their fullest potential, with a deeper consideration of the role that narratives may play.

Future Directions

Prior research indicates that individuals tend to overestimate their own navigational abilities, although this effect is less pronounced for college-aged individuals than older adults (van der Ham, van der Kuil, & Claessen, 2020). With that said, although perceived ease of navigation is an important construct in its own right with significant psychological ramifications, the observed effects related to perceived ease of navigation do not necessarily imply the same for an individual's actual ease of navigation. Consequently, it would be valuable for future research to assess actual navigational ease alongside self-perceptions in order to discern whether the effects observed upon perceived

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ease of navigation also apply to individuals' tangible experiences therein.

Beyond that, mobile devices used in guided tours often result in different interpretations of the same materials when presented to the user, resulting in differences in the ability to successfully navigate the tour. In this study, the perceived plausibility of the narrative and the device used to deliver that narrative had a significant effect on perceived ease of navigation. As such, future researchers may wish to develop best practices for developing guided mobile tours that make use of plausible narratives.

Relatedly, the present study focused on an educational experience, in which users might expect a degree of narrative realism. In other contexts in which the acquisition of knowledge is less important, plausibility may not be as essential. Researchers should therefore examine a variety of tour contexts, as the nature and purpose of any given tour may moderate the relationships identified in this study.

Moreover, guided tours in general increasingly make use of technologies, and the principles guiding the delivery of tours are interpretive in nature, so it stands to reason that critically examining long held beliefs (e.g., Ham, 2010) about the efficacy of interpretation and the potential long-term effects of narrative engagement would benefit scholarship on mobile media and psychology as well as the development of multimedia applications, among other areas. Therefore, scholarship should continue to explore the role of communication delivered via narratives within a guided tour, recognizing that, as humans are natural storytellers, the optimal method of delivering narratives will likely be specific to the type of tour and goal (Skibins, Powell, & Stern, 2012). Regardless, exploring the role of narrative believability in guided mobile tours and the theoretical frameworks that guide them is crucial to deliver optimal experiences for users today.

Implications

As this study demonstrated, when a narrative is integrated into a guided mobile tour, the plausibility of that narrative is an important determinant of its usefulness. This makes a degree of sense: if a user does not find a narrative to be remotely plausible and thus does not accept its overall storyline, then that story will likely do little to augment the user's navigational

success. Thus, it is important to ensure that the activities of characters and the events that transpire within the narrative are reasonably similar to what one would expect to happen in the real world. This does not necessitate that the narrative be nonfiction; on the contrary, the use of obviously fictional constructs like the "holographic tour guide" in this study are perfectly acceptable, as long as the tour guide behaves in a manner that is otherwise relatively familiar (i.e., what one would expect from a "non-holographic" tour guide). This affords technical communicators significant creative license in developing engaging stories in which their respective audiences may immerse themselves.

On the other hand, the manner in which the narrative handles factual information does not appear to be as essential. In this study, the perception that the narrative had "loose ends" or was otherwise missing important information (coverage) did not have a statistically significant effect on users' perceived ease of navigation. Likewise, internal inconsistencies and disagreements with other information that the users knew to be true (consistency) did not have a discernible effect, nor did the narrative's conformity to expectations about story structure (completeness) play a role. Such factors might affect a user's enjoyment of the narrative, and perhaps of the tour itself, but they did not influence the individual's perceptions of his or her ease of navigation. This is especially important given that the use of multiple navigation aids does appear to improve perceptions of narrative consistency and coverage but worsens perceptions of the actual navigation process. In short, using multiple media may improve users' enjoyment of the narrative, but in the context of a guided mobile tour, this is likely not worth the loss of effective navigation (or the perception therein). Thus, in this context, technical communicators should plan for each user to employ a single navigation aid with a sufficiently plausible narrative to augment the wayfinding process. However, in other contexts for which engagement with the environment is not a primary goal, it may be beneficial to provide the same narrative via multiple media, as doing so may enrich the user's evaluations of the narrative without the downside of harming navigational efficacy.

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APPENDIX A

Narrative Believability Scale (NBS-12)
Plausibility
1. I believe this story could be true.
2. This story was plausible.
3. This story seems to be true.

Completeness
1. It was easy to follow the story from beginning to end.
2. It was hard to follow this story. (R)
3. If I were writing this story, I would have organized it differently. (R)

Consistency
1. The information presented in this story was consistent.
2. All of the facts in this story agreed with each other.
3. The "consistency" of a story refers to the extent to which the story does not contradict itself or contradict other things you know to be true or false. How would you rate this story in terms of "consistency"?*

Coverage
1. There was important information missing from this story. (R)
2. There were lots of "holes" in this story. (R)
3. The "coverage" of a story refers to the extent to which the story accounts for all of the information presented in the story. How would you rate this story in terms of "coverage"?*

(R) denotes reverse-coded items.
* denotes seven-point scales with response values of "Very Low," "Low," "Somewhat Low," "Neither Low nor High," "Somewhat High," "High," and "Very High."
Note: All items not denoted by * were five-point scales with response values of "Strongly Disagree," "Disagree," "Neither Agree nor Disagree," "Agree," and "Strongly Agree"

Need for Cognition Scale (NFC)
1. I would prefer complex to simple problems.
2. I like to have the responsibility of handling a situation that requires a lot of thinking.
3. Thinking is not my idea of fun. (R)
4. I would rather do something that requires little thought than something that is sure to challenge my thinking abilities. (R)
5. I try to anticipate and avoid situations where there is likely a chance I will have to think in depth about something. (R)
6. I find satisfaction in deliberating hard and for long hours.
7. I only think as hard as I have to. (R)
8. I prefer to think about small, daily projects to long-term ones. (R)
9. I like tasks that require little thought once I've learned them. (R)
10. The idea of relying on thought to make my way to the top appeals to me.
11. I really enjoy a task that involves coming up with new solutions to problems.
12. Learning new ways to think doesn't excite me very much. (R)
13. I prefer my life to be filled with puzzles that I must solve.
14. The notion of thinking abstractly is appealing to me.
15. I would prefer a task that is intellectual, difficult, and important to one that is somewhat important but does not require much thought.
16. I feel relief rather than satisfaction after completing a task that required a lot of mental effort. (R)

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17. It's enough for me that something gets the job done; I don't care how or why it works. (R)
18. I usually end up deliberating about issues even when they do not affect me personally.

(R) denotes reverse-coded items.

Note: All items were five-point scales with response values of "Strongly Disagree," "Disagree," "Neither Agree nor Disagree," "Agree," and "Strongly Agree"

Perceived Ease of Navigation

Overall, how much trouble did you have finding your way from stop to stop?

Note: This item was a three-point scale with response values of "A lot of trouble," "Some trouble," and "No trouble," as well as an "I do not know" option.

mHealth Apps and Usability: Using User-Generated Content to Explore Users' Experiences with a Civilian First Responder App

By Candice A. Welhausen and Kristin Marie Bivens

ABSTRACT

Purpose: This study uses a qualitative content analysis approach to analyze existing user-generated content (UGC) for a civilian first responder mobile health or mHealth app, PulsePoint Respond. We argue that online review comments for these apps, the type of UGC we analyzed, can provide a rich source of untapped data for practitioners working in UX. We offer a UGC commenting heuristic that can help practitioners more effectively identify users' functional and productive usability concerns.

Method: We analyzed review comments (n=599) about PulsePoint Respond posted on the iOS platform between September 2016 and November 2019. Using open card sorting for data reduction, we eliminated 307 comments. We then created preliminary codes for the remaining 292 comments and used affinity diagramming to discuss, define, and finalize categories in order to analyze the final sample.

Results: We created a total of 14 categories, including "Unusable" or not actionable comments (307) and comments that were classified as "Multiple Categories" (45). The remaining 12 categories included Accurate Notifications (28), Audio (49), Compatibility and Integrations (8), Currency (58), Improvements (49), Location (27), More Agencies (50), Naming and Descriptions (41), Operating System/Battery/Memory (6), Privacy (4), Updates (8), and Usability/Interface (23).

Conclusion: We found that functional usability considerations remain important for users. However, many users also commented on the limitations of particular functionalities and/or described actions they sought to perform that were not supported by the app. Drawing from our analysis, we propose a UGC commenting heuristic that can help practitioners more effectively identify users' functional and productive usability concerns.

Keywords: mHealth Apps; UGC; Content Analysis; UGC commenting heuristic; UX

Practitioner's Takeaway

- Practitioners can draw from existing online review comments posted for mHealth apps to learn more about users and their functional and productive usability concerns.
- Practitioners can use the UGC commenting heuristic offered in this article to assist and/or prompt users to provide more actionable and valuable information in their online reviews that can be extracted and used to inform practitioners' UX work with mHealth apps.

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INTRODUCTION

Since their inception, mobile health applications—often referred to as mHealth apps—have been touted for their potential to improve health outcomes (Fiordelli, Diviani, & Schulz, 2013). As these tools have continued to proliferate (see Pohl, 2019), they have frequently been presented as enabling a culture of participatory health that can empower users to make more informed decisions by enabling particular kinds of health promotion and disease prevention behaviors (e.g., diet and exercise tracking) and/or assisting users in managing chronic illnesses and conditions. This intervention-driven emphasis has, in turn, prompted an extensive body of usability research on mHealth apps focused on improving the functionality of these applications (e.g., see Jake-Schoffman et al., 2017).

Ensuring that these apps work as intended—that is, that they are easy to use (see Mirel, 2004)—remains critically important. However, the emphasis on functional-level concerns in these studies may reflect the interests of app developers and creators, including healthcare providers and other subject matter experts, rather than users. Indeed, scholarship in the rhetoric of health and medicine has documented the ways that patients have modified some mHealth technologies to better meet their needs (Arduser, 2018; Bivens, Arduser, Welhausen, & Faris, 2018) and argued that some users of a crowd-sourced, flu-tracking program use this tool to make their own risk assessments (Welhausen, 2017).

Given our focus on audience in technical and professional communication (TPC), usability is a key area of interest (Redish & Barnum, 2011), and many practitioners are likely performing user experience (UX) work (Lauer & Brumberger, 2016). TPC-focused usability research has found that users often have their own goals and objectives when they use digital technologies, which may differ from what designers intended (Simmons & Zoetewey, 2012). In all likelihood, users of mHealth apps, too, engage in similar kinds of practices. However, this perspective has not been explored in TPC scholarship.

This article addresses this opening from a UX perspective, which Lauer and Brumberger (2016) state "[i]deally,. . . strives to accommodate how users appropriate information products and content in unanticipated ways and for their own purposes as well as how those products position users to act in the world

by the way they are designed and the options they allow for" (p. 249). More specifically, we analyze the self-reported experiences, feedback, and perceptions of users of PulsePoint Respond (e.g., see Welhausen & Bivens, 2019), one of two civilian first responder apps developed by the PulsePoint Foundation, by conducting a content analysis of review comments about the app posted on the iOS platform.

Through our analysis of this user-generated content (UGC), we found that functional usability considerations remain important for users. More specifically, many review comments described specific problems users encountered while performing or attempting to perform certain tasks. Yet we also found that some reviews focused on the limitations of particular functionalities and/or described actions that the user wanted to perform but were not supported by the app. We argue that this finding emphasizes the need to better understand users' "productive usability" (Simmons & Zoetewey, 2012) experiences with these tools and that analyzing online review comments can provide a rich source of untapped data in facilitating this effort. More specifically, the focus of this study aligns with Gallagher et al.'s (2020) claim that content analysis can help technical communicators better understand users and interactions between users in online environments.

To demonstrate this and in what follows, we next describe PulsePoint's two apps—Respond and AED (Automated External Defibrillator)—before situating our work within previous approaches to UGC in TPC and describing our methodology including our norming process for conducting our content analysis. We then present our analysis of the PulsePoint Respond comment sample and discuss the implications of our analysis. Finally, we provide a *UGC commenting heuristic* that practitioners can apply in spaces where users provide comments such as feedback forms or on app download pages to guide their commenting practices. We propose that practitioners can use our heuristic to prompt users to provide more substantive and actionable feedback in review comments, which can then be used to better identify users' functional and productive usability concerns.

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ABOUT PULSEPOINT

PulsePoint (PulsePoint.org) was created as a not-for-profit organization that released two location-aware apps in 2010 designed to work together to reduce deaths from sudden cardiac arrest (SCA): PulsePoint Respond and PulsePoint AED. PulsePoint Respond alerts users who are willing to perform cardiopulmonary resuscitation (CPR) when someone nearby (within one-fourth of a mile) is experiencing SCA. This app is integrated with local emergency services and sends a smartphone alert (triggered by a 911 call) to users who have registered to provide CPR when someone in their nearby area is experiencing SCA (see Figure 1; left). SCA kills 70-90% of people who experience it because frequently CPR or defibrillation is not administered in time to save the person's life (Sudden Cardiac Arrest Foundation, 2019). Indeed, studies investigating volunteer-based networks of lay-trained CPR responders found that individuals who experience SCA and receive CPR from bystanders showed increases in survival (Hansen et al., 2015).

PulsePoint AED uses crowdsourcing to document locations of AED machines (Figure 1), which users who respond to an alert for CPR can access as needed. This app allows users to view AEDs in their area and to also add these devices' locations. This crowdsourced map information is then reviewed for accuracy and approval (i.e., vetted) before it is added to the AED app. Users contributing crowdsourced information about an AED also need to describe the AED's location as well as provide a panned image of its location and immediate surroundings. PulsePoint AED's functionalities differ from PulsePoint Respond. Consequently, this article only addresses the latter.

Figure 1. These screenshots show a CPR alert for PulsePoint Respond (left) and a crowdsourced map for PulsePoint AED (right). Images used with permission.

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TECHNICAL COMMUNICATION AND USER-GENERATED CONTENT

Scholarship in TPC that focuses on UGC—that is, "media content created or produced by the general public rather than by paid professionals and primarily distributed on the Internet," as Daughtery, Easton, and Bright (2008, p. 16) defined the concept—has increasingly recognized the ways that this information is shaping the workplace practices of technical communicators. Indeed, this personal, publicly available information (Naab & Sehl, 2017, see p. 1258) has become a common venue that organizations use to provide support/documentation (White & Cheung, 2015) with many companies acknowledging that UGC is often highly valued by consumers (Ledbetter, 2018). For instance, TPC-focused research has extensively explored the ways that credibility and trustworthiness are established in product reviews, a specific genre of UGC (see Mackiewicz, 2010a; 2010b; 2014; 2015; Mackiewicz, Yeats, & Thornton, 2016). Consequently, practitioners are increasingly "analyz[ing], synthesiz[ing], and respond[ing] to user-generated content as part of their daily duties," as Mackiewicz, Yeats, and Thornton (2016, p. 72; see also Mackiewicz, 2015) pointed out. Further, as Gallagher et al. (2020) stated in their study on UGC and "big data audience analysis": "In the twenty-first century, technical communicators need to read, respond, curate, manage, and monitor user-generated content . . . " (p. 155).

Indeed, while UGC had previously been seen as undermining the work of practitioners (Carliner, 2012), more recent scholarship has argued that this information can, in fact, inform technical communicators' approaches to content creation and management. As Mackiewicz (2015) put it in her article on strategies to evaluate "helpfulness votes" for consumer products, "Technical communicators are playing a substantial role in the development and management of UGC" (p. 4-5). For instance, Frith (2017) has argued that crowdsourced online forums allow technical communicators to take on "new roles as 'community managers'" (p. 12; see also Frith, 2014). White and Cheung's (2015) study on user-generated fantasy sports media presented options for more effectively engaging readers, and Getto and Labriola (2019) offered a heuristic for creating "user-driven content strategies" (p. 385).

Scholarship in TPC has also argued that UGC can help technical communicators better understand the subject matter of the content they are working with as well as lend insight into audience as Lam and Biggerstaff's (2019) study on software development illustrated. This emphasis on UGC to increase audience awareness can also be seen in Ledbetter's (2018) study on YouTube make-up tutorials and Gallagher et al.'s (2020) quantitative analysis of online comments responding to articles in *The New York Times*. More specifically, Ledbetter (2018) connected UGC to usability by arguing that the creation of user-generated videos suggests that "we need to broaden and deepen our understanding of what *usable* means [which] will enable us to better understand and account for practices . . . that diverse audiences value" (italics in original; p. 288). Gallagher et al. (2020), on the other hand, focusing on a different genre of UGC, proposed a method for analyzing big datasets. They argued that their approach "can assist technical communicators with better understanding the habits and exchanges of their participatory users because this understanding can help them design better *commenting practices,* procedures, and functionalities" (p. 155; emphasis added)—a goal we share and account for in the UGC commenting heuristic we present later.

Content analysis is an established methodology in TPC research that has been used both qualitatively (e.g., Geisler, 2018) and quantitatively (e.g., Brumberger & Lauer, 2015)—including by Gallagher et al. (2020)—to "expose hidden connections among concepts, reveal relationships among ideas that initially seem unconnected, and inform the decision-making processes associated with many technical communication practices" (Thayer, Evans, McBride, Queen, & Spyridakis, 2007, p. 267). This method has also routinely been used in UGC-focused research in communications-related fields (Naab & Sehl, 2017) and in usability studies on mHealth apps (e.g., Jake-Schoffman et al., 2017; Liew et al., 2019; Middelweerd et al., 2014) albeit with a focus on the content of the app rather than the content of patient/user feedback. Indeed, the extent to which UGC might be used qualitatively to better understand users' practices within the context of mHealth apps from a TPC perspective has not been explored.

This study addresses this gap by reporting the results of a project in which we analyzed online review

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comments for a civilian first responder mHealth app that draws upon off-duty healthcare workers and those trained in CPR to assist during SCA (Welhausen & Bivens, 2019). More specifically, we use a scaffolded, qualitative content analysis approach to argue that this specific genre of UGC can lend insight into users' functional and productive usability practices, which can, in turn, inform the workplaces practices of practitioners engaged in UX work. Like Gallagher et al. (2020), we start by using UGC to understand audiences and their use of a specific technology—the PulsePoint Respond app. However, our qualitative approach allowed us to tease out specific categories for classifying comments that we then use to develop a UGC commenting heuristic. Practitioners can use this heuristic to assist and/or prompt users to provide more actionable and valuable information that can be extracted and used to inform their UX work with mHealth apps.

DATA ANALYSIS METHOD

Our sample consisted of 599 review comments from the iOS platform posted between September 23, 2016 and November 5, 2019 (the date we stopped compiling comments).[1] Our research team for the final analysis portion of the study consisted of the two authors and two undergraduate student research assistants. Because our project was funded and included working with students, we used a hybrid method of 1) open card sorting and 2) affinity diagramming to analyze the UGC we collected as a research team. Independently and prior to meeting as a group, each team member used open card sorting to familiarize themselves with the comments and independently create preliminary codes. We then convened as a group and conducted a training session during which we discussed our independent open card sorting results, talked through coding discrepancies, agreed upon final categories, and defined each category. These categories are shown in Table 1. After this step, we used affinity diagramming to classify the same preliminary dataset of 486 comments that each research team member had previously independently coded via open card sorting. At this point, we printed out the comments, attached these

comments to sticky notes, and divided the stack of these notes into fourths. Each member of our research team was then responsible for categorizing one of the stacks (i.e., approximately one-fourth of the preliminary dataset) via affinity diagramming. Based on our hybrid card sorting-affinity diagramming process and discussions, Table 1 below includes the final categories, the user-oriented definitions of the categories that we created, and examples of codes we used to generate these definitions.

Narrowing qualitative data (i.e., the qualitative data reduction process) is typically used to begin analyzing field notes and transcriptions (Miles & Huberman, 1994). Additionally, we simplified our dataset by eliminating user comments that did not provide substantive or actionable feedback. To do this work, during open card sorting each member of the research team removed comments (both positive and negative) from their coding stack that only gave a general, holistic assessment/opinion about the app and did not provide specific, substantive detail(s) about the user's experience. If a team member was unsure as to whether a comment was substantive, during the training session another team member reviewed the comment, and both team members worked together to reach consensus. We categorized these non-substantive comments as "unusable" because they provided general praise or disdain without a reason (e.g., "app works great!" or "very informative") or developers for the PulsePoint Foundation would not have been able to make changes to the app based on the comment's content. To illustrate, one respondent stated: "We live near a major thoroughfare that has a bunch of accidents randomly throughout the day and night. This app lets me know proactively to avoid the thoroughfare." Another stated: "This app got me motivated to sign up for CPR classes. Love listening to the local radio activity. Now when fire and ambulance go by my office, I know what they are responding to. Awesome!" These statements, while not included in our content analysis categories described in Table 1, are still valuable examples of the kinds of comments many users made and were used to inform the prompts included in our UGC commenting heuristic described later.

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1 Initially, we harvested comments from both iOS and Android platforms; however, since the student research assistants who assisted with the analysis were working part-time and approaching final examinations, out of respect for their already full schedules, we opted to focus our analysis on the iOS comments, thus reducing our sample size by several hundred comments.

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Table 1. Categories, user-oriented definitions, and selection of examples of codes

Category	User-Oriented Definition	Examples of Codes*
Accurate Notifications	Users described wanting correct app notifications regarding the particularities of accidents.	Accident • details • information • lack of information
Audio	Users noted needing sound enhancements from the app.	• dispatch • radio • sound • notification sounds
Compatibility and Integrations	Users wanted better app integrations with devices.	• work with other devices • problems with iOS
Currency	Users critiqued timely delivery of app information related to accidents.	• updates notifications late • delays • faster • not current
Improvements	Users sought mapping and customizing app improvements.	Radius Customization • specific calls • detailed notifications
Location	Users reported mapping errors related to locating and routing.	• routing • GPS • maps • AED
More Agencies	Users requested app integration into specific communities.	• expansion • coverage • wanting it here
Naming and Descriptions	Users wanted clearer alert categorization and consistency.	• alert naming • alert categorization • clear legend • naming emergency
Operating System/ Battery/ Memory	Users decried the phone resources required to run the app.	• networks • call time • battery draining • too much phone memory
Privacy	Users provided legal information regarding personal privacy and the app.	• legal protections • gives personal address • Health Insurance Privacy and Portability Act (HIPPA) law • minor child
Updates	Users queried about prior and forthcoming app features.	• what happened to. . . ? • when will you bring back. . .? • when will there be an update? • why did the update include. . .?
Usability/Interface	Users provided basic app functionality issues.	• operating system crashes • scanner doesn't work • when I do this. . . this happens instead • hard to read or hear

*Some example codes appear in more than one category because some codes fit into multiple categories

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Our analytical process in creating the categories described in Table 1 involved iteratively generating and defining categories directly from our dataset of UGC rather than using those included in an existing usability heuristic such as Morville's (U.S. Dept. of Health and Human Services, 2021) well-known honeycomb diagram, for example, or Nielsen's (2012) classifications. It also provided an opportunity for our variously skilled research team to acquaint ourselves with the comments in our dataset prior to affinity diagramming and to scaffold the overall process for the novice undergraduate researchers on our team (we describe this pedagogical scaffolding process in Bivens & Welhausen, 2021). Comments that focused only on the AED app were also eliminated, and a total of 599 total comments (an additional 113 comments that had recently been harvested from the iOS platform were also coded) were then categorized independently based on the in-person norming we conducted. In total, 307 comments were not usable, which was over 50% of the comments we downloaded. Thus, our final dataset consisted of 292 comments that were classified using the categories shown in Table 2 below, which also includes example representative comments. All the comments assigned to each category during the affinity diagramming stage were reviewed by the authors. To resolve discrepancies and disagreements, the team discussed the problematic comment and came to consensus as a group to assign the category.

RESULTS

As we stated earlier, both PulsePoint apps were created primarily to reduce deaths from SCA. Thus, the
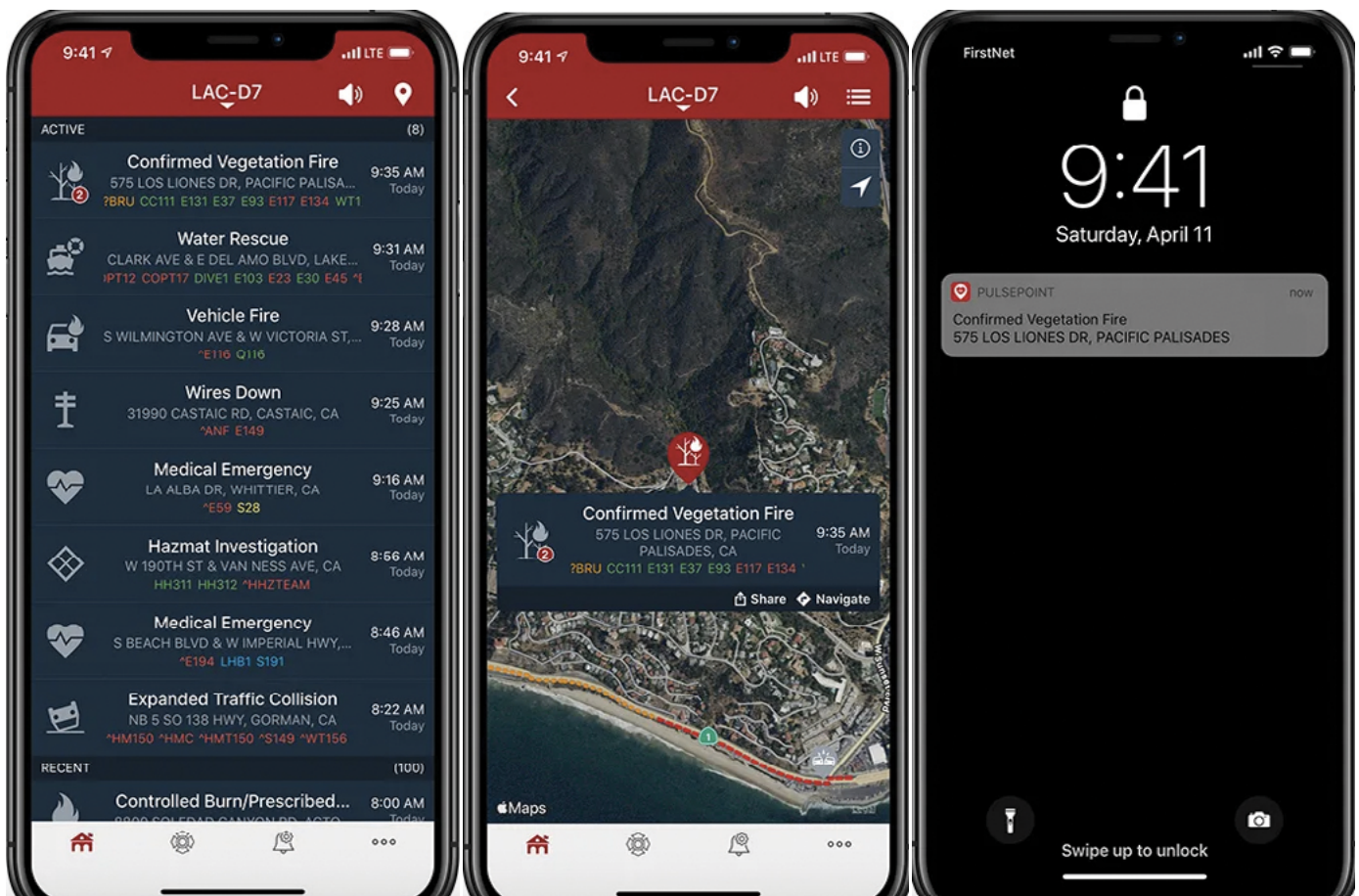
Figure 2. These screenshots show PulsePoint's traffic scanner feature. The left panel shows different types of emergencies covered by the user's local emergency response department. The middle panel shows detailed information for the first alert on the list in the left panel—a map of the vegetation fire's location. The right panel shows the alert/notification the user would have received about this emergency event. Images used with permission.

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Table 2. Categories and example representative comments for each category

Category	Representative Comments*
Accurate Notifications	"I have enabled all notifications in PulsePoint and my settings, yet I never see any alerts." "It no longer shows what units are responding to an emergency."
Audio	"The radio reception could be better." "I wish this app had radio traffic with it."
Compatibility and Integrations	"Do you plan on making this app compatible with Apple Watch?" "I use it daily. I just wish you guys could come out with an iPad Pro version of the app ASAP!"
Currency	"Pulse Point is always about 3-4 minutes late before you get an alert, and half the time you don't. There have been multiple car accidents close to me that I go to, and there are already ambulances on scene because I was so late getting the notification."
Improvements	"The ability to turn off critical alerts needs to be emphasized during setup. Also, the app settings need to allow for a defined area of alerts in relation to location." "Great app but I only want to hear foreground channels not dispatch or EMS channels."
Location	"The map never works when I pick an incident." "I cannot access the satellite view anymore; it is helpful to pinpoint exact locations of friends that could have medical emergencies."
More Agencies	"Needs more Kansas City metro departments." "It needs to cover Jefferson County in Missouri and as well as Rock Community Fire Protection District and Rock Township Ambulance District."
Multiple Categories	"It appears to be focused on downtown Napa, which doesn't apply to me. I was hoping for more all-Valley alerts. "(**More Agencies and Improvements**) "I wish you guys would add options where we can pick only our station. And be able to cut off Charlie or Alpha 1 when we are listening to the working fire channel for Prince George's County Fire Department." (**Audio and Improvements**).
Naming and Descriptions	"I wish it would tell what the codes are." "The app is great. The only issue I have is that under the notifications tab there are not enough categories."
Operating System/ Battery/ Memory	"Works well on Wi-Fi but does not load when using 4G." "Good information. Quick look up to pace you if doing chest compressions. With location tracking it can incrementally drain battery life."
Privacy	"The only thing bad I have to say is that on certain types of calls it gives someone's personal address out for any and all to see."
Updates	"I really wish that after a scene of an accident they gave some sort of report of what happened."
Usability/Interface	"The app is awesome. The only issue I have is that certain things are in red so I can't see the status on the screen." "I downloaded the app so I could see what my husband gets into while at work. I have the button to turn the scanner on, but it is light gray and won't turn on for me. Any suggestions?"

*Some comments have been edited for clarity, concision, and mechanical and grammatical correctness

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PulsePoint Foundation positions its apps primarily as civilian first responder tools. However, we found that most of the UGC in our dataset addressed specific features of the traffic scanner, a functionality that lists major emergency events covered by the user's local emergency response department (e.g., "traffic collision," "medical emergency," "vegetation fire"). More specifically, when users launch PulsePoint Respond, the traffic scanner feature loads first (see Figure 2; left panel). Users can use their touchscreen to select an alert in order to see more detailed information, which appears on a map with its location (Figure 2; middle panel). Users can also set the app's notifications feature to receive alerts for specific kinds of emergencies (see Figure 2; right panel).

Indeed, most review comments discussed the traffic scanner feature with only a few comments in our dataset specifically describing the user's experience responding to or attempting to respond to an alert to perform CPR. To illustrate, one reviewer stated: "I was at work [when] the alert went off . . . CPR needed suite 1100 . . . I ran to suite 1100 . . . [she was] unresponsive and pulseless . . . I started CPR . . . did 2 rounds . . . she had pulses. Wow.

That was amazing!" These kinds of responses, however, appeared very infrequently. Thus, it could be argued that PulsePoint Respond is primarily an emergency alert tool rather than an emergency intervention app. At the very least, it is both, which demonstrates that some users use the app in more routine, less intervening ways--that is, to check the status of traffic and/or emergency events in their area much like they might use Waze or Google Maps and not necessarily to provide CPR to those who experience SCA.

To now provide specific counts for each of our categories described in Tables 1 and 2, Figure 3 shows the number of responses for each of the major categories described in Table 2. More specifically, most comments in our UGC dataset critiqued the Currency of the app—that is, the delivery of app information related to accidents—followed by More Agencies, Audio, and Improvements, respectively. Privacy was the least common category in our analysis followed by Operating System/Battery/Memory, Updates, and Compatibility and Integrations.

Forty-five (45) comments were categorized as Multiple Categories—that is, the comment could be
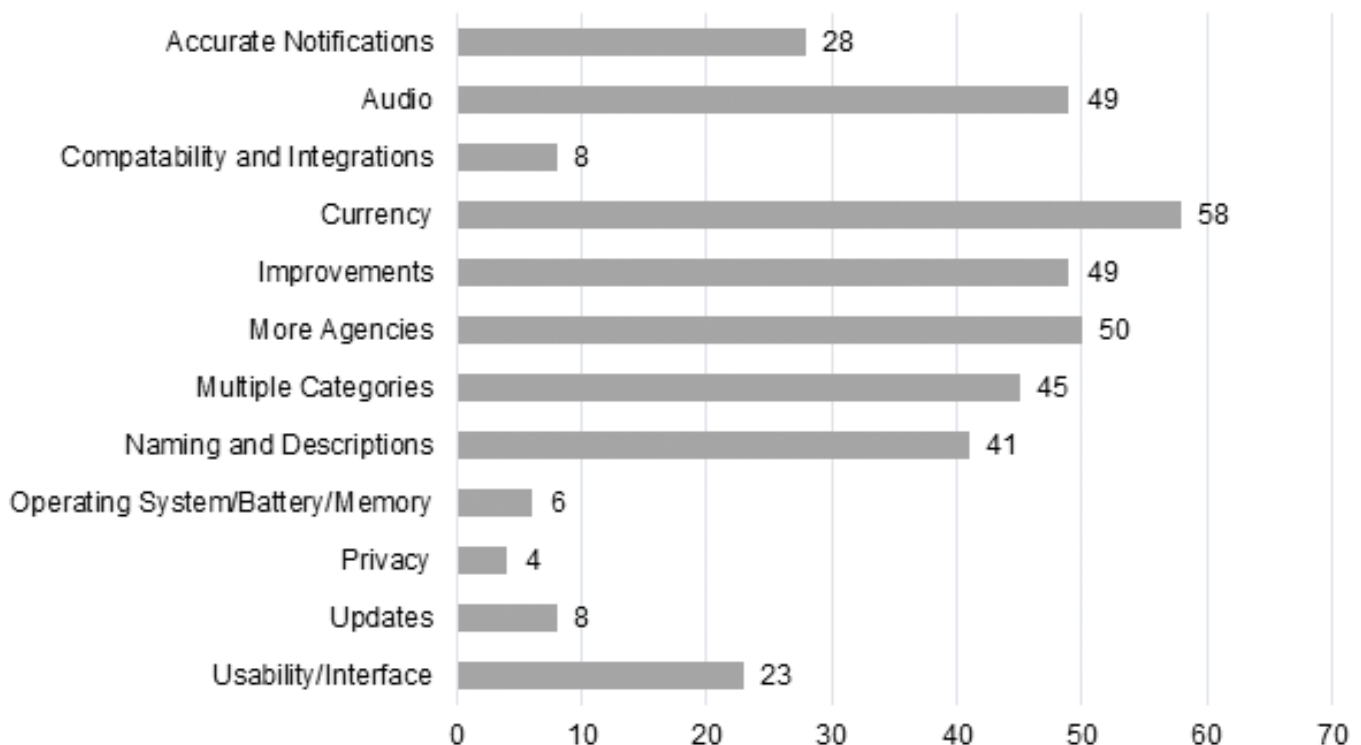
Figure 3. Content analysis categories for PulsePoint Respond comments and count for categorization of each comment

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classified in more than one of our categories. These counts are shown in Figure 4. More specifically, for the 45 Multiple Categories comments, Figure 4 shows the breakdown across the other categories, that is the multiple categories the comments were placed in. For example, if a comment was classified as fitting into Multiple Categories, there were at least two categories used to classify the comment. However, some comments were categorized as fitting in three, four, or even five other categories. To illustrate, 18 of the 45 comments in the Multiple Categories were classified as Improvements, 15 were classified as Currency, 12 as Audio and Naming and Descriptions, and 11 as Accurate Notifications.

DISCUSSION

In this study, we explored the citizen first responder app PulsePoint Respond from a broad UX perspective, which Law et al. (2009) have defined as "dynamic, context-dependent, and subjective" (p. 719). Indeed, PulsePoint Respond is unique among mHealth apps

because although it is still intervention-focused, this tool (along with PulsePoint AED) was designed to be used in a very specific healthcare context to address a very specific purpose—connecting citizens with other citizens who can provide life-saving care (i.e., CPR and/or defibrillation). Overall, the results of our analysis demonstrate that users find value in the app well beyond the CPR functionality alert as the vast majority of review comments focused on the traffic scanner as outlined in Figures 3 and 4. This major finding alone, we suggest, reflects the move toward productive usability—that is, users are using the app specifically in ways that meet their needs. More to the point, it demonstrates that while PulsePoint Respond has been positioned as primarily an emergency response tool, it is being used in routine ways.

Continuing for a moment with our observation of routine rather than emergency use, our preliminary results published elsewhere (Welhausen & Bivens, 2019) also found that some reviewers self-identified as current or retired emergency response workers. More specifically, these reviewers discussed using the app to
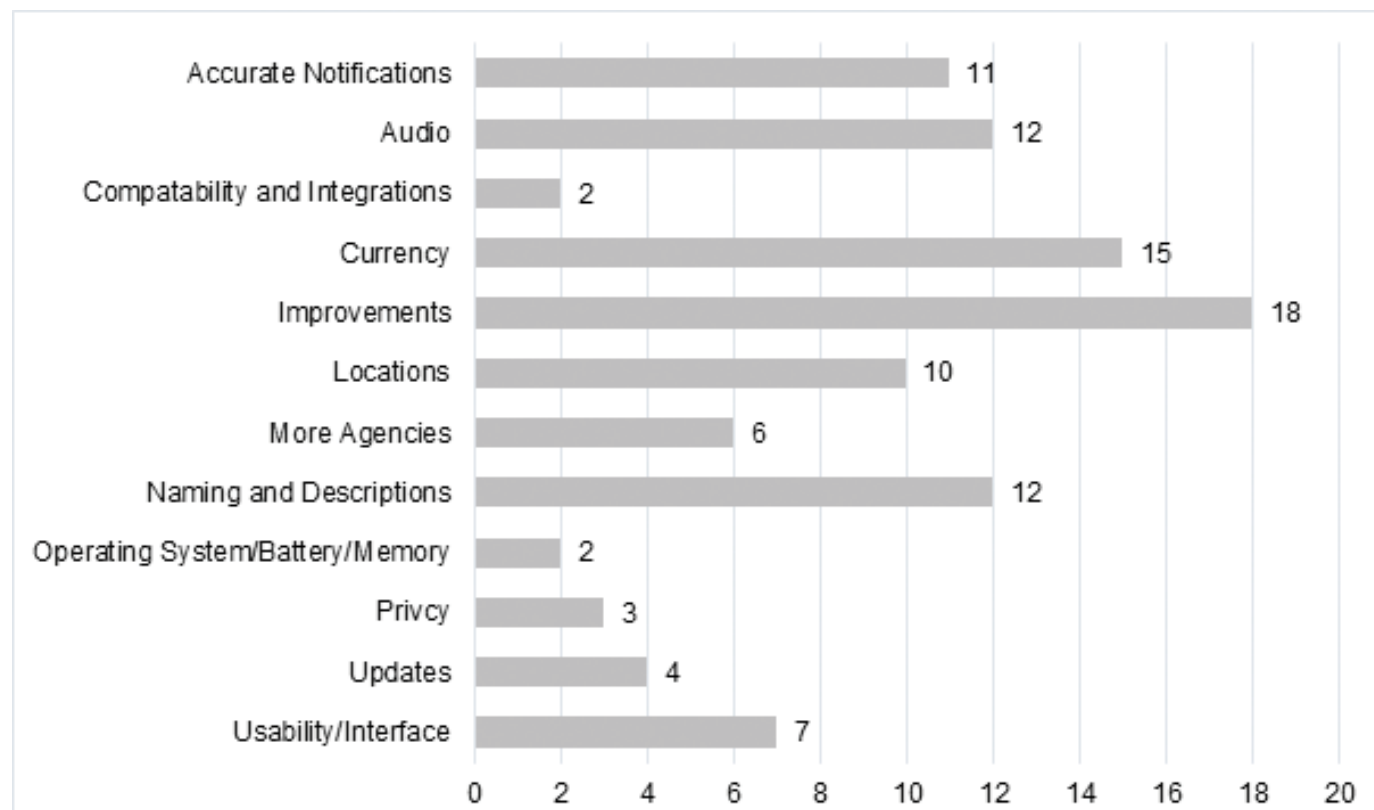
Figure 4. Content analysis comments categorized in multiple categories and category count for comments categorized as multiple categories

make, respond to, or to be informed about emergency response decisions, describing the ways they used the app to "dispatch" and/or "clear" calls. Interestingly, some of these users also reported using the app to perform their emergency response jobs. As one reviewer stated: "I use this app at work . . . to know what units are on calls." These users have specialized knowledge, experience, and expertise, which made their review comments particularly valuable in informing our UGC commenting heuristic.

The categories in Table 1, too, demonstrate that functional-level usability concerns remain important. More specifically, we suggest that review comments classified as Accurate Notifications, Audio, Location, Operating System/Battery/Memory, and Usability/Interface are concerned with how these features work—that is, "how well ... user[s] can navigate through a variety of tasks that [this] end product was designed to facilitate" (Lauer & Brumberger, 2016, p. 249). Conversely, categories like Compatibility and Integrations, Currency, Improvements, More Agencies, Naming and Descriptions, Privacy, and Updates, we propose, focus specifically on productive

usability considerations. More to the point, rather than describing specific problems with the current functional capabilities of the app, the comments in these categories forecast actions that users *want* to perform that are not currently supported. To illustrate using our definitions from Table 1 and our examples from Table 2, users want the app to be integrated with other devices (e.g., Compatibility and Integrations) like the Apple Watch, for instance. They want more timely delivery of app information related to accidents (e.g., Currency). They also want the app to attend to Privacy considerations in the way that some information is presented, and they want particular kinds of Updates like being able to access after-accident reports, as the example comment for this category in Table 2 demonstrates. Making changes to the app to address the feedback in these categories is not just a matter of fixing the app's programming as it currently exists. Rather, responding to these categories requires including new functionalities as well as modifying existing ones. Thus, the comments in these categories describe the "productive" ways that users want to use PulsePoint Respond.

Table 3. User-generated content (UGC) commenting heuristic

Suggested Prompt	Reasoning	Example
Ask users to add details and examples with reminder text prior to submission. *This prompt aims to direct users to include specific details in their feedback.*	By adding a reminder that automatically appears after a user selects "submit," users will be able to review their comment and add details if they have not done so.	Include a dialogue box that thanks, then asks users to review their comment and add specific examples to qualify their comment.
Add a direct link from the app download page or homepage to a series of questions that will help users categorize their comment. *This prompt aims to focus the content of comments that users write.*	By linking to focused questions, users will be able to better pinpoint the category their comment falls into. Or, if it does not, an "other" option is available.	Include a link to pre-commenting sorting questions (with an "other" option) for users to categorize their feedback or details of their review prior to posting it.
Include a mechanism that allows users to view a selection of categories. *This prompt aims to extract relevant kinds of information from users.*	By providing pre-determined categories, users will be able to consider what kind of feedback is useful.	Include a drop-down menu (with an "other" option) that asks users to choose the category that best fits their feedback topic.
Provide an example of an actionable comment. *This prompt aims to extract substantive feedback from users.*	By sharing an example comment, users can see the kind of information they might provide in their review	Include an example comment that makes a specific claim in one sentence, then provides specific details in subsequent supporting sentences.

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APPLYING A USER-GENERATED CONTENT COMMENTING HEURISTIC

In this section, we draw from the content of the comments describing these productive usability needs to propose the UGC commenting heuristic shown below in Table 3. More specifically, Table 3 describes prompts that can be transformed into a menu that allows users to categorize their comment type and/or adapted into a series of example comments pinned on the app home or download pages. Integrating these prompts can then guide the response of users who choose to leave comments.

To illustrate, content managers might use elements of the heuristic in a drop-down menu like the comment field in PulsePoint Respond's feedback form (see Figure 5). The app's feedback form might also include predetermined categories or a dialogue box reminder to include specific examples. Elements of the commenting heuristic can also be used to generate pinned example comments that might be included, when possible, on an app's home or download pages such as the page on the PulsePoint Foundation's website where users can download the organization's two apps (see *www.pulsepoint.org/download*). These prompts can easily be integrated by other apps' content managers and web designers.

As another example showing how our commenting heuristic might be implemented, technical marketing writers could also apply the heuristic to learn more about the audiences they research by prompting users to describe their complaints and compliments in feedback forms (as shown in Figure 5). For example, PulsePoint Respond users find the app useful. Yet they also found functionalities that can be improved. Cueing these users to include detailed descriptions to contextualize and qualify their complaint or compliment would benefit technical marketing writers as they seek to understand their audiences. These writers might also incorporate options for users who leave feedback to include demographic information. Indeed, as our sample scenarios demonstrate, our heuristic in Table 3 is designed to help practitioners gather detailed, focused, relevant, substantive feedback from mHealth app users by directing and structuring the commentary they provide in their reviews.

Figure 5. PulsePoint Respond feedback form. Image used with permission.

STUDY LIMITATIONS, JUSTIFICATION, AND FINAL THOUGHTS

Although usability research can be completed remotely (for example, TryMyUI or Validately), generally more traditional approaches require direct interactions with users. More specifically, in order to learn how users use a particular artifact (e.g., software/support documentation, video tutorials, mHealth apps), usability researchers need to observe users' interactions with that artifact. Yet as we discuss in the literature review, scholarship in TPC contends that UGC offers new opportunities for technical communication practitioners to develop and manage content for their users and to learn more about them. At the same time, because UGC does not necessarily provide the same kinds of information as usability testing, for example, relying on UGC to understand users' practices and experiences does pose limitations.

In our study, for instance, although we have endeavored to ensure consistency in our interpretation of review comments through our coding and categorization method described earlier, it was not possible to follow-up with reviewers either to clarify their comments and/or to acquire additional

information. Thus, the comments in our UGC dataset may not reflect how most PulsePoint Respond users are experiencing the app's functionalities. Further, individual users might comment on a particular problem and/or experience that is unique to them but may not necessarily be representative. Such discrepancies are easier to determine when UX researchers are using traditional usability testing. Since all participants are performing the same tasks, users tend to have similar characteristics (e.g., all participants are novice or expert users), and usability practitioners can directly interact with users.

That said, our approach in this article does not seek to replace other usability methods like observations and/or usability testing, for instance. Rather, we have sought to uncover information about users' experiences that may not be procured through these more structured approaches that are designed specifically to tease out functional usability problems. Indeed, because review comments are open-ended, users can, in theory, focus on the aspects of the app that most interest them rather than being guided by specific evaluation tasks and criteria created by app developers, which may not reflect users' values and interests.

At the same time, review comments, too, are subjective, opinion-based, and may not necessarily be useful. As we stated earlier, our total pool of UGC was initially 599 comments. However, our final dataset was whittled down considerably after eliminating comments that offered no actionable information. Indeed, we were surprised that over half of the comments that we harvested were unusable. In reality, tens of thousands of reviews have been posted about the PulsePoint apps to the iOS platform, and we consulted first with the PulsePoint Foundation and later with a programmer to determine if all of these comments could be scraped. The programmer who assisted us could only download the most recent 500 comments, and the PulsePoint Foundation did not have access to the remainder. After our initial download, we were able to pull some new comments. However, ultimately, we were limited in the total number we could harvest. Had we been able to acquire all of these comments, we would have then needed to use a quantitative analytical approach [such as that developed by Gallagher et al. (2020)], which would have required us to rely on "computational approaches" (p. 156), as they did, to extract themes—a

"labor-intensive" process that can be prohibitive for multiple reasons, as they explain (see p. 166-167).

Gallagher et al.'s (2020) methodology was well suited for their subject matter and the goals of their study. However, working with our much smaller dataset had some clear benefits. It allowed us to eliminate unusable comments—a task, arguably, that would not have been possible had we been working with a very large dataset of UGC. Indeed, using a software program to extract keywords would have shown us major linguistic patterns in our UGC and thus would have lent a different kind of insight into our data. However, this technology would not have been able to differentiate between actionable and not actionable comments. Rather, our qualitative analytical approach allowed us to tease out nuanced themes (codes) directly from the UGC we used, which we then refined into detailed categories and ultimately a UGC commenting heuristic. Thus, we suggest that our study does not offer a competing perspective to Gallagher et al. (2020) but a complementary approach that may be more appropriate for particular kinds of usability studies that draw on UGC and smaller sample sizes. At the same time, we acknowledge that our commenting prompts might not be of interest to technical communicators with physical access to users during usability testing. However, if physical access to users is not possible—the ongoing COVID-19 pandemic provides an example—it might be advisable to consider and use other sources of user feedback.

Finally, it is important to acknowledge that the comments we collected from the iOS platform span a three-year time frame, and during this period multiple upgrades have been made to the app. As this article goes to press, PulsePoint Respond is currently on version 4.12, whereas on September 3, 2016, the app was on version 3.16 (Apple Store Preview, 2021). Thus, some of the functional and productive usability concerns we discuss may have already been addressed. Indeed, the traffic scanner function is now featured more prominently on their website (perhaps in response to the organization recognizing its popularity among users) and in their description of the app on Apple's App Store than when we conducted our analysis for this project. Nonetheless, our research highlights the importance and utility of these comments and offers strategies for soliciting more substantive, valuable feedback from users who wish to provide app reviews

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and comments, generally. As an additional point here, app developers and usability practitioners will also be aware of changes that have already been made to the app and its different iterations. Thus, they can group review comments chronologically and make decisions about how to implement review feedback based on the most current version of the app.

In Naab and Sehl's (2017) systematic review of UGC research in communication-related fields, they point out—and we agree—that disciplinary lines naturally cross where research questions intermingle regarding research on recipients and UGC. In this way, our work continues along the same line as Gallagher et al.'s (2020) study while also contributing to ample UGC content analysis in technical communication writ large as well as the push toward integrating users "as collaborators" (Getto & Labriola, 2019, p. 396) in the creation of information.

ACKNOWLEDGMENTS

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Books Reviewed in This Issue

The reviews provided here are those that are self-selected by the reviewers from a provided list of available titles over a specific date range. Want to become a book reviewer? Contact Dr. Jackie Damrau at jdamrau3@gmail.com for more information.

A Math-Based Writing System for Engineers: Sentence Algebra & Document Algorithms

Brad Henderson. 2020. Springer. [ISBN 978-3-030-10754-3. 365 pages, including index. US$119.99 (hardcover).]
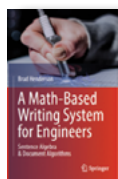
English grammar and writing skills can be difficult to learn—and even more challenging to follow. For the engineer, mathematician, or scientist who is more familiar with mathematic formulas than grammar rules, Brad Henderson's *A Math-Based Writing System for Engineers: Sentence Algebra & Document Algorithms* unlocks the hidden patterns and codes of professional writing and translates them into algebraic expressions and algorithms. His goal for the text is simple: to provide highly technical and engineering professionals with a just-in-time resource for learning how to write professionally.

With a professional and educational background in engineering and writing, Henderson knows his subject matter and his audience. His examples are precise, and his explanations are thorough. In Part I, he presents a grammar primer using algebraic terms to classify common parts of speech. In Part II, Henderson shares strategies for optimizing sentence construction, building from the foundation of Part I and integrating new rules that emphasize simplicity, clarity, and style optimization. Finally, in Part III, Henderson shares five document algorithms to coach readers through writing specific professional publications—project proposals, status reports, project reports, tech briefs, and instructional job aids.

A Math-Based Writing System for Engineers has been written for engineers but could be particularly helpful in any STEM-based profession where formulas, rules, and algorithms are the cadence of daily work. Engineering students might also benefit from the approach to writing as it offers a reliable mechanism for writing grammatically correct documents and technical publications. Engineering communication instructors will find the book well organized and practically structured to support coursework in the subject area. Surprisingly, the book might also be a particularly helpful resource for ESL engineers.

Readers should be prepared for lots of algebraic variables, formulas, and algorithms. The text is not written for those suffering from arithmophobia. But for those seeking formulas and patterns to complex grammar rules that can be used to write effective, efficient documentation, this text delivers.

Throughout *A Math-Based Writing System for Engineers*, Henderson offers practical, strategic writing advice for writing clearly and concisely in a variety of formats. His approach to formulating grammar rules into mathematical expressions and algorithms will serve engineering audiences particularly well.

Jennifer Goode

Jennifer Goode is a senior STC member and teaches technical communication at Mercer University, where she directs the online master's program in technical communication management. With professional experience in government, non-profits, and for-profits, she also consults in instructional design, e-learning, strategic human capital performance, measurement, and improvement.

Make It Clear: Speak and Write to Persuade and Inform

Patrick Henry Winston. 2020. The MIT Press. [ISBN 978-0-262-53938-8. 338 pages, including index. US$34.95 (softcover).]

"Essentials of Being Remembered" is one of the memorable chapters in *Make It Clear: Speak and Write to Persuade and Inform*. This chapter is an example of how Patrick Winston has a fresh take on the basics of writing to persuade and inform in this handsome tome.

For writing to be remembered, the author argues that a writer should use Winston's star to include surprise, symbol, story, slogan, and saliency (p. 21). So, to remember this review, consider the surprise to be the use of Winston's star in the review. The symbol is the cover of *Make It Clear*. The story is that the author was a much-remembered professor at MIT (teaching for four decades). The slogan would be that making writing to be remembered is a great goal. Saliency would be that *Make It Clear* would be a great choice for teachers to use in a class and anyone interested in good writing.

The scope of *Make It Clear* is impressive. It covers both how to write and speak to get ideas across. This includes covering how to organize thoughts and how to approach writing and rewriting. It even covers how to choose an effective type and how to prepare great

presentation slides. Winston even covers topics such as defeating writer's block.

Judge for yourself if you think Winston does a good job of explaining about a choice of fonts when he says, "Type aficionados argue about whether serif or sans serif type families are more readable. On slides, there should be so few words and the size should be so large that readability is not an issue with any of the popular choices" (p. 242). I actually like what Winston has to say here.

Jeanette Evans

Jeanette Evans is an STC Associate Fellow; active in the Ohio STC community, currently serving on the newsletter committee; and co-author of an Intercom column on emerging technologies in education. She holds an MS in technical communication management from Mercer University.

A History of Arab Graphic Design

Bahia Shehab and Haytham Nawar. 2020. The American University in Cairo Press. [ISBN 978-977-416-891-8. 384 pages, including index. US$49.95 (softcover).]
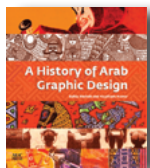
A History of Arab Graphic Design is a groundbreaking publication, one of the first English language accounts of a non-western history of graphic design, written by Bahia Shehab and Haytham Nawar, professors at The American University of Cairo. It explores the history of graphic design in Arab regions of the world and by Arab designers working in the diaspora. The breadth of time and geography which this book covers is a major undertaking. The authors acknowledge the limitations of their book, which include lack of archived materials, extensive political turmoil in many of the regions covered, and the difficulties gaining permissions to use work on the publication, a common issue in producing historical books about art and design. Despite these limitations, the book is a successful undertaking and, as a first edition, we can hope for future editions with advancements in this valuable historical research.

The history examines the work of influential designers, the impact of technology, and educational institutions, and focuses mainly on design history after 1900, where most of the development of modern Arab graphic design practice begins. However, the authors still examine the roots of design including the development of Islamic ornaments, vegetal and geometric, as well as calligraphy and connections to the Islamic faith. The authors also acknowledge a strong influence from western design practices stemming colonial pasts and Arab designers in the diaspora. Many of the designers included were educated in the west and returned home to educate new generations of designers, resulting in schools that are described as "emulating western educational systems" (p. 44).

The authors also show a strong connection to technology and advancements in design; interestingly some significant advancements in western culture, such as the development of the printing press, is less meaningful in Arab culture, as the calligraphic writing styles were difficult to adapt to printing technologies such as letterpress, Linotype, and typewriters. It is interesting to note that dry rub transfer letters had a substantial impact on Arab graphic design due to the ease of use without compromising Arabic scripts, whereas Letraset is a mere footnote in most western design histories. The authors also show a distinct connection between calligraphy and the history of graphic design throughout the book, even modern practices are a balance of calligraphy and design.

A History of Arab Graphic Design is filled with exquisite examples and is worth buying for the images alone, but of course a better appreciation for the work and the contexts in which they were created is gained by reading the rich history that accompanies the images. Some of the most moving examples are from the Palestinian resistance, but without context these would be significantly less poignant. It is a survey of Arab history, and like many surveys it skims many topics leaving the reader wanting more details, but that is the nature of surveys. A work of this nature is a major undertaking and should be regarded as a foundation, though an excellent one, that will hopefully be built on in the future.

Amanda Horton

Amanda Horton holds an MFA in Design and currently teaches graduate and undergraduate courses at the University of Central Oklahoma (UCO) in the areas of design history, theory, and criticism. She is also the director of the Design History Minor at UCO.

On the Offensive: Prejudice in Language Past & Present

Karen Stollznow. 2020. Cambridge University Press. [ISBN 978-1-108-79178-6. 322 pages, including index. US$15.95 (softcover).]

For some people, language is a minefield, especially regarding what is considered offensive. Although there are times when using a particular term to hurt or assert power over someone is intentional, there are just as many times (if not more) when offending someone is unintentional and results from not knowing, or understanding, how language influences people and their lives. Karen Stollznow's *On the Offensive: Prejudice in Language Past & Present* aims to answer the questions "'*What* is offensive?' and '*Why* is that offensive?'" (p. 7) so that readers may understand and empathize with the "life experiences and challenges of other people, through the lens of language" (p. 10).

To say that this book is packed with information is an understatement. Stollznow has a lot of territory to cover when it comes to offensive language, and although she claims the book is not a comprehensive catalog, she covers an array of topics, such as race, gender, sex, religion, mental wellness, physical looks, and age. What may surprise readers is how complex each of these topics can get. For instance, when reading about physical looks, the topic is not just about attractive versus unattractive. She begins by explaining how "human oddities" were exploited by showmen like P.T. Barnum, and how people who have characteristics that sometimes stand out are still very much discriminated against today, but then she delves into height, physical differences, physical disability, the equation of beauty to goodness and ugliness to badness, transformation (ugly duckling metaphor), beauty in Hollywood, weight, clothing, hair color, and so much more. Each chapter is packed with information on what words or phrases are offensive, why they are offensive, and most important, acceptable, unoffensive, alternatives, and why they are preferred terms now.

Even though Stollznow is clear that this book "is not about censoring language" (p. 6), I must admit that I was overwhelmed by all the words and phrases that are offensive. And even though she offered alternatives, it was tough to keep track of what is offensive, which could lead to the question: What can you say today that is *not* offensive? Too much of the answer to that question comes in the Conclusion, unfortunately,

which I think would work better if readers encountered it upfront. For instance, she explains that this book is meant to provide information about how language evolves, give readers more choices, and raise "awareness of prejudice in language" by "standing outside of ourselves and considering the world from the point of view of someone who is different to us" (p. 252). If that context was provided in the beginning, then readers might not enter the book from a "me" perspective but rather from the viewpoint of people on the receiving end of those words and phrases. *On the Offensive* is, however, an excellent read and resource on one of the most important subjects in our society.

Diane Martinez

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The Cambridge Introduction to Narrative

H. Porter Abbott. 2021. 3rd ed. Cambridge University Press. [ISBN 978-1-108-82335-7. 292 pages, including index. US$29.99 (softcover).]

Presenting itself as "a foundational book" (p. xvii), H. Porter Abbott's updated *The Cambridge Introduction to Narrative* is comprehensive, detailed, authoritative, and accessibly written. It ranges across literature, film, drama, digital narratives, and video games; is organized in a systematic, usable way; and offers an excellent glossary and bibliography—a resource valuable to student and teacher alike.

As Porter explains, story and narrative are related yet different. Story is a "chronological sequence of events involving entities" such as "acts and happenings" and "characters" (p. 261). Narrative is "*the representation of an event or a series of events,*" the "*telling* of a story" (pp. 12, 256). Paradoxically, only through narrative can the story itself, the actual events described by the narrative, be inferred. Narrative therefore appears to be a fundamental human characteristic that mediates how we understand the world.

As representation, narrative can disrupt the strict chronology of story (flashbacks) or connect elements in non-sequential ways (motifs). Narrative is in effect

"infinitely malleable" (p. 16) and controllable by the represener, or narrator, who may or may not be part of the action represented. Narrative creates an arc of expectation and fulfillment, a form, that repeats the fundamental human experience of time as having a beginning, middle, and end. However localized a narrative may be, it ultimately repeats the structure of "masterplots" or archetypes, such as the hero's journey, that appear universal in human experience (pp. 52–56, 254–255), and that reflect time's linearity.

Narrative also evokes spatial dimensions: "action makes space" (p. 169). In Bakhtin's terms, narrative "thickens" time by involving space, creating a "chronotope," or compression of time and space into space-time, where one cannot exist without the other (p. 171). Narrating a story, we are "acquiring a picture" (p. 171). Looking at a picture, "narrative templates in our minds" explain what it depicts (p. 8).

Narratives, however, are "by their very nature . . riddled with gaps" (p. 96). Narratives can suddenly deviate into a backstory, skip over intermediate events into future situations, or juxtapose disparate settings to create a sense of simultaneity. Such gaps compel interpretation from the reader or viewer and make explicit the construction of time inherent to narrative. Gaps occur even in scientific narratives, in exceptions to the evidence that invite speculation: "Facts, in short, don't speak for themselves. They must be interpreted" (p. 161).
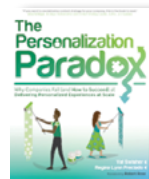
The inability of even scientific narrative to coincide exactly with the world it describes implies a distinction between narrative "closure" and "ending". Closure occurs when the expectations raised by the action are fulfilled; ending when readers believe all questions raised by the narrative have been answered. Especially in literature, but also inevitably in science, expectations may be adequately fulfilled while questions always remain. Given such an important role in the quest for understanding, narrative deserves serious study, and Abbott's book offers an excellent place to start.

Donald R. Riccomini

Donald R. Riccomini is an STC member and Emeritus Senior Lecturer in English at Santa Clara University, where he specialized in engineering and technical communications. He previously spent twenty-three years in high technology as a technical writer, engineer, manager, and director in semiconductors, instrumentation, and server development.

The Personalization Paradox: Why Companies Fail (and How to Succeed) at Delivering Personalized Experiences at Scale

The Personalization Paradox: Why Companies Fail (and How to Succeed) at Delivering Personalized Experiences at Scale is a book that every content strategist will want to have in their reference library. Val Swisher and Regina Lynn Preciado provide a very structured, to-the-point discussion on personalization at scale. The back cover states, "The only way to deliver personalized experiences at scale is to standardize your content. That's right: **standardization enables personalization**. We call this brain-twister **The Personalization Paradox**."

Personalization at scale is delivering "the right content to the right person at the right time on the right device in the language [of] their choosing" (p. ix) Delivering personalization can be done in a manual way, where "you create, manage, store, update, and retire different content for each person, persona, or customer type" (p. ix), or in an automated way, where you use sophisticated tools to try to match the content to the customer. Personalization fails because we focus on the content delivery not the content creation and management; we invest in tools and systems without transforming the content; and we do not look at it holistically as we tend to trap the content in silos within our companies.

The authors say, "Historically, we were taught to create content by starting at "page 1" and writing to the end of the asset" (p. xi). With personalization, the authors tell us to "create and use small, nimble chunks of content … that can be combined in different ways for different people and different devices, you *must* standardize everything about that content: the words and images you use, the ways in which you use those words, the paragraphs and sets of paragraphs, and the overall tone and voice" (p. xi). These small content chunks are content components that apply well to content reuse easily wherever needed to match the content to the customer.

Content reuse requires setting up a strategy before starting. It is "not the same as *copy, paste, tweak (CPT)*. **You cannot use copy, paste, tweak to deliver personalization at scale**" (pp. 129, 132). A good reuse

strategy defines granularity (the smallest content piece for reuse), matrix (where the content will be reused), management (where you will reuse it), and governance (who can create, modify, or retire the reused content).

The authors state, "You must standardize your content first and manage it in a standardized content ecosystem. You cannot simply apply personalization to the end product and expect positive results" (p. 173). Content ecosystems include a "component content management system (CCMS), digital asset manager (DAM), and a personalized content delivery platform" (pp. 173–174).

Throughout *The Personalization Paradox*, you will find the chapters include real world experiences in which the authors have worked as well as quotes from other industry leaders who currently work in the structured content area.

Jackie Damrau

Jackie Damrau is an STC Fellow and serves as the book review editor for *Technical Communication.* She has more than 25 years of technical communication experience and works for a professional consulting organization as a senior business analyst. Jackie loves reading mysteries and historical fiction.

Better Data Visualizations: A Guide for Scholars, Researchers, and Wonks

Jonathan Schwabish. 2021. Columbia University Press. [ISBN 978-0-231-19311-5. 450 pages, including index. US$28.95 (softcover).]

When *Better Data Visualizations: A Guide for Scholars, Researchers, and Wonks* arrived, I immediately thumbed through it, excited to read it. If you think creating charts of data isn't interesting, perhaps you need to read this wonderful, full-color book. Not only is the book well designed from fonts to white space, it's also well written and enjoyable to read. I even laughed a few times at some of the examples, including one from Alberto Cairo, an academic who "drew a dinosaur with points in a scatterplot" (p. 256) complete with an image of said dinosaur. Besides being entertaining, this book is a must for students who have to learn data visualization and instructors who teach the subject—plus any professional who puts data into images.

Better Data Visualizations contains three parts. The first part, "Principles of data visualization," has three chapters that cover visual processing, five guidelines to follow, and—something taught in all writing courses—audience analysis. One gem is a two-page breakdown of data types (p. 46) that should be an exemplar in technical communication courses to illustrate how to explain complicated topics using analogies and following a classification structure. Part one alone is a concise series of lessons that help you think about your data and classify it in such a way that you'll know how best to present it to your audience.

Part two, by far the largest section, is an encyclopedia of chart types organized by the goal (or function) of the chart. Types range from the obvious (changes over time) to the complicated (azimuthal projection maps). One interesting example is a Sankey diagram showing how "fifty-two students tried to spell" *camouflage*, starting with all students getting the C right but then diverging into eleven different results (p. 126). Part two ends with an elegant lesson on formatting tables for visual effect. Every reader is bound to learn from the many examples here.

Many technical communicators will appreciate that the last part of this book includes a chapter on creating a style guide for charts, including fonts, colors, labels, and so on. The text also instructs readers on subjects like choosing colors appropriate for those with color vision deficiency.

Better Data Visualizations ends with "lessons learned" and includes a brief appendix on tools to create charts, another appendix with further readings, a list of references, and a thorough index—one that I appreciated particularly as a reference to famous examples of data visualizations. For example, I noted John Snow, the British doctor who tracked cholera in London by mapping the cases as clusters (in what I learned is called a Voronoi diagram) to pinpoint a particular contaminated water pump. Not only are the over 500 examples instructive in teaching the type of visualization being presented, but most of them are also real-world examples that in themselves make valuable history lessons.

If you read this text and follow its guidelines, you'll be able to effectively present your data—and you might enjoy the process like I did.

Kelly A. Harrison
Kelly A. Harrison, MFA, teaches technical communication at Stanford University. Formerly, she taught a range of writing courses at San José State University and wrote for various high-tech companies. Kelly is the Associate Editor for *West Trade Review.*

Colourworks: Chromatic Innovation In Modern French Poetry and Art Writing

Susan Harrow. 2020. Bloomsbury Visual Arts. [ISBN 978-1-350-18220-2. 238 pages, including index. US$115.00 (hardcover).]

Colourworks: Chromatic Innovation In Modern French Poetry and Art Writing by Susan Harrow is an immersive book analyzing color in modern French poetry and art writing. A Professor of French at the University of Bristol, Harrow's monograph is based on her research interests at the intersection of French poetry and visual culture. Written in three parts, Harrow uses the poetry and art writing of three canonical figures of modernist French poetry including Mallarmé, Valéry, and Bonnefoy to address questions about readers' response and the textual life of color in the writing. Modern French poetry is self-explanatory but perhaps art writing is not, Harrow includes any prose written from these poets that is in response to art, whether contemporary or historic.

In Part 1 of *Colourworks*, Harrow begins by examining the works of Mallarmé as the establishment of modernist poetry. She discusses Mallarmé's work through distinct examinations of black, blue, and white as well as through his connections to the impressionist artist Manet. Part 2 covers an analysis of Valéry with a deeper look at color in sections that approach the use of "carroty-red" in Valéry's writing as well as his use of Chiaroscuro, which is interesting to think of Chiaroscuro, a common technique in painting that contrasts light and shadow in the same composition, as used in poetry. But probably the most interesting analysis in part 2 is the use of Ekphrasis, which Harrow explains as, "To read a poem in ekphrastic terms through a painting which is not an actual source for the poet, but an analogue of that poem" (p. 105) Finally, part 3 examines the writing of Bonnefoy about grey and white, but also ethics and ekphrastics.

The author's use of ekphrasis to analyze the writing of Valéry and Bonnefoy remind the reader that the analysis of both painting and poetry is subjective. Harrow's deep interest in and knowledge of poetry is evident in her own expressive writing style. *Colourworks* is filled with vivid descriptions such as when she describes Mallarmé as "Awakening to the mesmeric power of fractured colour in the modernist work" (p. 29). Perhaps one of her best descriptions of color, from the section on Mallarmé, is on the work of Baudelaire, in which Harrow states, "Already for Baudelaire, black was the colour of the century, synonymous with the rise of the bourgeoisie—with its strait jacketed hegemony" (p. 41).

Colourworks is for a very distinct academic audience of French studies, yet there is interdisciplinary crossover of poetry and visual culture. The reading requires a familiarity with the works analyzed, as the longer form poems are not included in their entirety and requires a good working knowledge of the French language; only longer passages are translated; and the book contains a fair number of citations in the body in the original language untranslated. The writing is dense at times but always maintains its own poetic air.

Amanda Horton
Amanda Horton holds an MFA in Design and currently teaches graduate and undergraduate courses at the University of Central Oklahoma (UCO) in the areas of design history, theory, and criticism. She is also the director of the Design History Minor at UCO.

Online Learning for Dummies

Susan Manning and Kevin E Johnson. 2021. John Wiley & Sons Inc. [ISBN 978-1-119-75686-6. 394 pages. US$24.99 (softcover).]
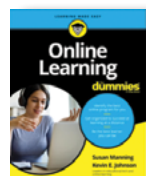
If you have recently been tapped by a college to share your expertise, regarding technical communication or even a unique hobby, the class you teach is likely online. Never fear. All you need to know of the basics, what's necessary to work professionally, and pointers to the latest information is available in *Online Learning for Dummies*.

Each author has credentialed knowledge in their separate spheres: Manning oversees design for client Learning Management Systems (LMS); Johnson directs distance learning at a western state college. The Canvas

LMS option demonstrated in their book is like others. An LMS provides a teacher all the tools to interact with their online students and vice versa.

I consulted a technical communication peer who has successfully shared his professional expertise in a local college-level class to prepare for this review. In Connecticut, they use Blackboard as the LMS tool. Reviewing Blackboard's list of features for online courses was impressive. The "Assignment" feature allows downloading and then uploading completed assignments while providing the online ability to assign grades. Other features allow collaboration in break out rooms with interactive white boards, a course calendar for students to set class times and reminders, and many tools to organize teachers. Schools provide online training for their specific LMS.

This *For Dummies* book does not automatically assume you are an expert with computers, so don't worry. Needed basics, from keyboards to hot keys, are added at exactly the right points. Guessing that your expertise is greater than average, feel free to skim or bypass entry-level sections.

If you are new to the institutional environment, you will appreciate content that gets you up to speed on facets of college life. Commonly known events are Orientation and tours; less known is the difference between models: the historic (independent) vs. cohort model (where students in a degree program all start together then veer off for optional choices to later return and graduate with the main group). Having time-saving tips, grading rubrics, and a wealth of other information stored in lists at the fingertips of a new professor, will soon make you an expert.

As the instructor, you will want to encourage students to interact with you and other students. LMS tools make it possible to provide for disability requirements. For example, advanced notice is needed by the instructor to arrange in-class sign-language translation for a hearing-impaired student. Gender identity can be quietly discovered by other classmates in their choice of pronouns used in sign-ins. This book is full of advice on manners, which is so important when people never meet in person but need to collaborate.

Media can be used when submitting assignments. Video and voice recordings can demonstrate a topic or be used to show how well the student handles a different language.

*Online Learning for Dummies* also includes helpful information regarding homeschooling online due to the 2020 pandemic. Although Zoom is the tool primarily used to teach the K-12 group, do not expect to learn that functionality in this book.

Donna Ford

Donna Ford has been an STC member and a technical writer in the hardware, software, and government healthcare industries. She holds an Information Design certificate from Bentley College. Donna is an author who also reviews books online for the US Review of Books.

The Myth of Multitasking: How "Doing It All" Gets Nothing Done
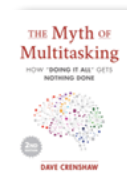
Dave Crenshaw uses a reader-friendly, story format to communicate the message in his book, *The Myth of Multitasking: How "Doing It All" Gets Nothing Done*. The story features a consultant who helps a stressed CEO improve her company's productivity. As the story progresses, the CEO (and readers) assess multitasking's negative impact on their work and personal lives and learn practical steps to avoid multitasking, thereby improving their productivity and well-being.

Crenshaw challenges the "myth" that people can multitask. He feels that what many people call multitasking—to use his own term—is actually "switchtasking." Rather than performing two activities at once, our brains are switching quickly between the tasks. Since a person is interrupting a task to move to another activity, there is a loss in concentration. Rather than making a person more productive, multitasking is actually inefficient. I found his categorization of switchtasking into active (those you initiate) and passive ("caused by someone or something other than you") designations a helpful tool in managing multitasking (p. 34). An example of the former is switching from a task to speak to someone while a common example of the latter is receiving text mail notifications.

The Myth of Multitasking is a good introduction to an activity that is unfortunately a part of many people's lives. Crenshaw also provides a fresh perspective on multi-tasking so people already familiar with the topic will find his insights helpful. For example, we are acquainted with multi-tasking's negative impact on

our time and productivity, but Crenshaw asserts that it also negatively affects our relationship with others. If someone is speaking and we are multi-tasking and distracted, we are relaying a message that we think that the person is not important enough to receive our full attention.

The book's content applies to managers and those who do not have direct reports. Crenshaw's discussion of multi-tasking as part of an organization's culture ("…a business is a reflection of its leadership") was enlightening (p. 13). He advises leaders to fix their personal systems before rolling out multitasking training to change business systems. A personal system is "… how you operate as one person: how you manage email and voicemail … your workspace or office organization … and so on" (p. 113), while a business system reflects an organization's processes and how employees communicate and manage things internally.

The Myth of Multitasking is a fast read due to its small size (5 x 7.5 inches), it is a good choice as a department or book club group reading. The book contains exercises with step-by step instructions and worksheets (including a link to download) to assist readers in understanding multitasking's impact on their lives and managing their time.

Ann Marie Queeney
Ann Marie Queeney is an STC senior member with more than 20 years' technical communication experience primarily in the medical device industry. Her STC experience includes serving as a Special Interest Group leader, 2020-2022 Board member, and current CAC (Communities Affairs Committee) Chair. Ann Marie is the owner of A.M. Queeney, LLC.

The Invention of Medicine: From Homer to Hippocrates

Robin Lane Fox. 2020. Basic Books. [ISBN 978-0-465-09344-1. 460 pages, including index. US$35.00. (hardcover).]

Many medical historians date the birth of modern medicine to the fifth century BCE, when Greek practitioners began producing the earliest known medical texts (p. 24). As technical writers, the use of writing as evidence of practice should not surprise us. However, Robin Lane Fox, author of *The Invention of Modern Medicine: From Homer to Hippocrates*, assures us that the invention of modern medicine, and even medical writing and communication, did not emerge from such a singular point in time. Rather, it was influenced by many cultures and practitioners.

As a technical communicator, I found Fox's discussion of the evolution of medical communication especially intriguing. While it is certainly true that the art of healing and communicating about medicine has origins deep in time, the ways in which we think and write about medicine did undergo a dramatic change starting with the Greek philosophers. Throughout *The Invention of Medicine,* Fox traces the evolution of modern thought and communication about medicine. For example, the discussion of the differences between medical knowledge and traditional beliefs, the use of the first-person "I" in scientific texts, and even instructions and cookbooks may all trace their development to the fifth century BCE in Greece (p. 24).

Fox draws upon a rich variety of examples from art, literature, and medical texts to illustrate her discussion of the practice of medicine across the ancient world. One of the most recognizable references is to Homer's *Iliad*, in which many highly specific anatomical references and descriptions of medical injuries are made, illustrating the extensive understanding of the human anatomy that the Greeks possessed as early as the seventh century BCE. However, ancient myths such as the Greek myth of Dawn and Tithonus are examined as well to discuss the ancient Greeks' views on aging, sex, and more (p. 58).

No book about medicine or even medical communication would be complete without illustrations. However, you won't find modern line drawings of the inner workings of the human body in this book. The final chapter of *The Invention of Medicine* is dedicated to a discussion of art depicting medical topics, featuring high-resolution color photographs of ancient medical texts, as well as paintings and reliefs depicting medical scenes and stories.

The Invention of Medicine is a deeply satisfying read for technical writing practitioners and scholars alike who share an interest in the origins of scientific and medical writing. Lane's writing is engaging and informative without weighing the reader down with copious footnotes and involved discussions of medical or communication theory. As a result, many in the technical communication field at all levels of expertise,

from advanced undergraduate student to seasoned practitioner, would enjoy this book.

Nicole St. Germaine

Nicole St. Germaine is a Professor in the Technical and Business Writing Program at Angelo State University, as well as a freelance writer and consultant. Her research interests include technical communication for a Mexican American audience and technical communication in the health fields.

The Environment: A History of the Idea

Paul Warde, Libby Robin, and Sverker Sörlin. 2021. John Hopkins University Press [ISBN 978-1-4214-4002-6. 244 pages, including index. US$24.95 (softcover).]

The word "environment" connotes representations of nature, climate change, the biosphere, individual flora and fauna, and much more, but the *idea* of the environment is not universal, and it is a word, a concept, that has had a relatively short but complex history. The environment is also the subject of much global conversation about the past, present, and future of humanity and Earth. *The Environment: A History of the Idea* is a timely read that provides a new perspective on the evolution of the environment, as a word, as a concept, as the subject of humanity's survival in the years to come.

The book is comprehensive and compelling in that it takes a seemingly common term and traces its evolution from when it was "borrowed from French into English in 1827" (p. 27) by Thomas Carlyle to the word as we know it today, a politically charged concept that has "become a way to visualize, rather than imagine, the future" (p. 179). *The Environment* is focused on the environment and not environmentalism as a social action. The authors are thorough in their research that takes readers on an evolutionary journey of the word and the idea through the post-World War II years when there was focus on global reconstruction and exploitation of natural resources.. It was also at this time when the first environmental organizations were born, some that were concerned with conservation and others that sought ways to "squeeze more wealth out of nature" (p. 40). In the 1970s, the environment took on other meanings as scientists learned how to model Earth's natural processes and use those models to make

predictions. Modeling and predictions led naturally to thinking of the environment in terms of how it should be regulated and governed, which opened the door to political conversations and governmental policies. In the 1980s, climate entered the realm of what was then considered the environment, and new perspectives about humanity's role in the environment brought about theories such as Earth System Science and Gaia Theory. The science behind the environment, however, could not be cordoned off to any field of science any more than one country could regulate how the environment should be used.

Even though the word *environment* was first used in American literature in 1827, over a century passed before it became a mainstream concept, so its history is only about 70 years old. But in that 70 years, the concept has evolved into the one word that now connotes the future of humanity. *The Environment* provides an enlightening discussion about the evolution of the idea and the many perspectives about this concept that have profound consequences for the future. Any student in the sciences, humanities, business, or economics would do themselves and the world a service to read this book and consider the history and evolution of this word and the consequences of its meaning in terms of our future.

Diane Martinez

Diane Martinez is an STC member and an associate professor of English at Western Carolina University where she teaches technical and professional writing. She previously worked as a technical writer in engineering, an online writing instructor, and an online writing center specialist.

Becoming a Technical Writer

Youlan Tao, Min Xie, Quan Zhou, Xiaoli Li, Shaowu Cheng. 2020. Fudan University Press. [ISBN 9787-309-15253-1. 245 pages, including index. US$6.06 (softcover).]

In China, the past two decades has witnessed the burgeoning field of technical communication and the increasing demand for trained graduates from college. Although China does not have an independent academic degree program in technical writing yet (pp. 43-44), some leading universities have offered regular courses, mainly to

students in the MTI (Master of Translation and Interpreting) programs to develop their technical translation capabilities. One of the urgent problems with the current curriculum is no local textbooks written for Chinese students. *Becoming a Technical Writer* is the first English-written textbook that has been published in China. It was jointly created by Chinese scholars, Chinese American scholars, and Chinese professionals in technical communication and translation. Although it mainly targets MTI students, professionals in technical communication and/or technical translation will find it useful.

This book contains five chapters. The introduction outlines the environment of technical communication in China, pointing out "technical writer" as a profession is "on its way [to] being recognized" by society (p. 38). The next four chapters are organized surrounding the four process stages of technical writing: planning, developing, revising, and delivering.

The Planning chapter narrates four steps for effective planning: analyzing users and contexts, conducting research, organizing content, and determining output formats. To meet the reader's need of writing interactive, online contents such as help messages or chatbot assistance, this book recommends a "progressive disclosure" (such as a set of momentary help, extended help, and full help) organization to realize customized, embedded, and effortless on-screen instructions.

In the Developing chapter, the authors cover key aspects in writing technical documents, including controlled language, style guides, structured writing, and authoring tools. Learning these aspects satisfies the MTI students' interest in writing for machine translation or for a global audience. This chapter also has a section about technical illustrations—the design principles, types, and how to work with them, a topic that translators need to know if they want to become technical writers.

The next chapter, Revising, details the types (phases) of reviewing technical documents, the complete process of usability testing, and the stages of technical editing.

Finally, the last chapter, Delivering, focuses on user feedback collection, document publishing, and document distribution. The authors point out that publishing and distribution is not the end for a technical document; instead, a technical writer should

analyze the users' feedback to improve the technical documents or the product itself. Doing so reminds the readers that technical writing is user centered.

As the first comprehensive, English-written technical writing textbook in China, *Becoming a Technical Writer* is a milestone in textbook development in technical communication education. Designed for Chinese graduate students in translation studies, this book caters to their practice of *technical writing as and for translation* in Chinese context. Being the first version, the book inevitably has some limitations, such as a table of contents that is too general, blurry visuals, and mechanical errors. I recommend that the authors consider adding sections with ethical discussions on technical communication, more specific guidelines about online content design, and a source book for instructors and students.

Lin Dong and Xiaozhen Liu

Lin Dong, PhD, is a lecturer who teaches Professional and Technical Writing to MTI students at the School of International Studies in the University of International Business and Economics, Beijing, China. She won the Best Paper Award at the 2020 IEEE ProComm Conference.

Xiaozhen Liu is a graduate student from the MTI program at the University of International Business and Economics. She contributed ideas from a target reader's perspective to an early draft of this review.

Liberating Economics: Feminist Perspectives on Families, Work, and Globalization

It is a story that many women around the world share: work one shift in the workplace, then go home to do unpaid care work, such as cooking dinner, cleaning up, and helping children do homework. Despite this "double shift," women in developed countries have made strides toward parity when compared with previous generations (p. 1). However, Drucilla K. Barker, Suzanne Bergeron, and Susan F. Feiner assure us in *Liberating Economics: Feminist Perspectives on Families, Work, and Globalization, Second Edition,* that women still have

work ahead of them to achieve equality in the workplace, in the global economy, and in family life.

Liberating Economics is an eye-opener for any reader with only passing knowledge of how gender and economics intersect. Liberal feminism assures us that if women get an education and work hard, they will rise in the workplace meritocracy (p. 10). However, feminism and economics are inextricably interlinked and more nuanced than many readers may imagine. For example, despite Liberal Feminism's focus on workplace equality, white women in the United States still only make USD 81.5 cents for every dollar a man makes, black women make USD 65.3 cents, and Latina women make even less (p. 1). The authors tease out the many reasons for disparities such as this one through the lenses of historical context, gender expectations, socioeconomic factors, modern workplace trends, and more.

Perhaps the greatest strength of *Liberating Economics* is its broad coverage of topics. Unlike most books that focus on feminism, work, and family, the authors do not solely focus on professional working women in developed countries. Instead, they cover women's economic lives globally by discussing the effects of culture, race, sexuality, gender identification, education, among others. Barker, et al. discuss everything from the transnational caring labor of Filipinas working abroad as nannies and domestics (p. 118) to the inefficacy of microloans to lift women out of long-term poverty (p. 137).

Liberating Economics is a straightforward read without focusing overmuch on complex economic theory. An advanced undergraduate student with only basic knowledge of economics could easily follow Barker, Bergeron, and Feiner's clear explanations and examples. Each chapter focuses on a clear theme, such as the gendered division of labor, women's poverty, and gender and crisis economics. Each chapter builds upon the last but is so clearly explained that a reader could review a chapter or two alone without losing the thread of the discussion. I would recommend this book to any professional or student who wishes to learn more about equity in the workplace or in global economics.

Nicole St. Germaine

Nicole St. Germaine is a Professor in the Technical and Business Writing Program at Angelo State University, as well as a freelance writer and consultant. Her research interests include technical communication for a Mexican American audience and technical communication in the health fields.

Dysfunctional Documents: A 12-Step Recovery Program for User Documentation

Kurt Ament. 2021. Levels of Edit. [ISBN 978-3-00-068352-7. 113 pages, including index. US$12.95 (softcover).]
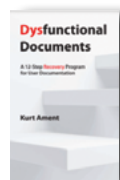
Dysfunctional Documents: A 12-Step Recovery Program for User Documentation is a delightful handbook that takes a practical, step-by-step approach to identifying and correcting the underlying problems in document sets. Kurt Ament takes his inspiration from the venerable *Levels of Edit* handbook, developed by Robert Van Buren and Mary Fran Buehler for Jet Propulsion Laboratories (JPL) and published by STC, and transforms the principles of editing into a 12-step recovery program.

The first thing you'll notice about *Dysfunctional Documents* is the book's physical size. Its small page format (5 inches by 8 inches) and its thin spine seem miniscule next to traditional technical editing volumes, which tend to be hundreds of pages in length. This smaller format is a feature—not a bug—which makes *Dysfunctional Documents* less intimidating than other editing texts. It's about the same size as my iPad mini, which makes it incredibly easy to slip into my bag on my way to my next class or meeting. Its price tag is also significantly smaller than many editing texts, which makes it easier to distribute to your entire team or assign as reading as part of a unit on editing in a technical communication course.

The book's contents are equally unintimidating and easy to read. Each chapter ranges from three to seven pages and offers concise and actionable advice. Ament, a long-time writer and editor of user documentation, takes a modular approach, breaking each chapter down into manageable topics. Each chapter includes an overview that clearly lays out who is involved at each stage in the recovery process and what their responsibilities are.

The recovery process advocated by *Dysfunctional Documents* is methodical and practical. Each stage in the recovery process is framed as an actionable step. Concepts described in each step are clearly defined and examples bring the concepts to life. Although the book outlines specific steps toward recovery, the advice is general enough that any technical publications team can apply the advice in ways that suit their documentation libraries and their dysfunctions.

Dysfunctional Documents also includes an appendix that illustrates the types of items writers and editors should consider adding to a styles guide. If your team relies on an outdated style guide—or has no style guide at all—you can use this appendix as an example for creating or revamping your in-house style.

As I read through the book, I found myself nodding my head as I thought about how my own team has been splintered into siloed products, how problems have started cropping up since we began working remotely, and how this recovery program could be applied to my team's document library. *Dysfunctional Documents* will be a useful resource for rehabilitating our vast document library.

Michael Opsteegh

Michael Opsteegh is an STC Associate Fellow and a technical writer in the software and financial services industries since 2004. He is a lecturer in the professional writing program at Cal State Long Beach. Michael holds a master's degree in English and is a Certified Technical Professional Communicator (CPTC).

Mid-Century Modern Women in the Visual Arts

Gloria Fowler, ed. 2020. Chronicle Chroma. [ISBN 978-1-6232-6118-4. 116 pages. US$24.95 (hardcover).]

Mid-Century Modern Women in the Visual Arts is a beautifully illustrated book highlighting 25 women who made an impact on western society, mainly the U.S. and U.K., from the 1940s–1960s. The women represent a broad swath of what can be termed the visual arts, including fine artists and designers such as painters, sculptors, and ceramicists, as well as architects, interior designers, fashion designers, graphic designers, and textile designers. There is even one model included, the ever iconic Twiggy is featured alongside fashion designer

Mary Quant. According to the editor Gloria Fowler, "All of the women included in this book had to overcome significant obstacles in society and their personal lives in order to pursue their dreams and realize their artistic ambitions." (p. 1)

The women are presented in two spreads, one fully illustrated spread and one spread that features the women's name and an object to represent their profession on the left, and a quote on the right. Twiggy and Mary Quant are the only individuals that share their spreads. Two things stood out here that reflect the larger issue of women and the credit they receive for their contributions.

The authors attribute the quote "Good design is good business" to Florence Knoll, a phrase that is often used to signify the embrace of design in the promotion of business in the U.S. that occurred in the mid-century era. This quote is often attributed to Thomas John Watson Jr., the CEO of IBM. Some initial research reveals that Knoll should likely get the credit having seemingly revealed this truth in a 1957 profile in the *New York Times*, where Watson apparently stated this in a 1966 memo. If it is true that Knoll said it first, then why does Watson get the credit.

On the other hand, the "object" chosen to represent graphic designer (and artist) Elaine Lustig Cohen appears to be a reference to a book cover design. And though she designed many books throughout her career, in this instance the illustration references the cover design for *Three Lives* by Gertrude Stein, which was not designed by Cohen but by her deceased husband, designer Alvin Lustig. Cohen designed so many covers, why was Lustig's illustration chosen to represent her? This choice oddly seems to reflect the larger issue that Lustig is often cited for his many contributions to design history in textbooks, while Cohen's are often overlooked.

This is a charming book whose quirky illustrations are reminiscent of the mid-century style. A complaint about the book is that there is so little text about the individual women, the bios are short containing roughly 100 words, and are only included at the end of the book. *Mid-Century Modern Women* also perhaps struggles with an identity problem, is it a children's book or an illustrated book for adults? It seems mostly likely, due to the format, that it is intended as a book for adults, a collector's item, but it might be better served to be slightly reformatted as a children's book.

Amanda Horton

Amanda Horton holds an MFA in Design and currently teaches graduate and undergraduate courses at the University of Central Oklahoma (UCO) in the areas of design history, theory, and criticism. She is also the director of the Design History Minor at UCO.

Understanding Clinical Papers

David Bowers, Allan House, David Owens, and Bridgette Bewick. 2021. 4th ed. Wiley Blackwell. [ISBN 978-1-119-57316-6. 290 pages, including index. US$50.00 (softcover).]
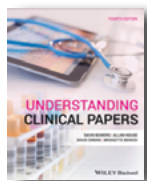
As we navigate the post pandemic world of vaccines and global health awareness, an understanding of clinical studies becomes relevant to all people, whether formally educated in research studies or not. The study of an idea/product/ process on human subjects in a clinical trial is the final step before something is introduced into human society. This complex process is outlined in *Understanding Clinical Papers* written by both quantitative and qualitative experts in their respective clinical fields: David Bowers, Allan House, David Owens, and Bridgette Bewick.

This book now in its fourth edition is a comprehensive, detailed account of how to read and understand both qualitative and quantitative clinical research. For anyone who wrote labs in school many of the headings and chapters will be familiar. The book's unique characteristics arise from a collaboration between four researchers with different areas of clinical specialization. Since the first edition was published more than twenty years ago, the authors have added entire chapters in new statistical analyses for study results and qualitative research. Much of the initial setup and results analysis differs between qualitative and quantitative research, and it is noticeable to have both analyzed and even synthesized together in current clinical research projects.

The first half of *Understanding Clinical Papers* explains the study design, research subjects, results identification, and methods of measurement. Initially, a reader will check superficial outcomes of the study: Are the results significant, is it worth reading, is it relevant and is it ethical? How do the researchers layout their initial hypothesis—or if not investigating a hypothesis—is it clear what new ideas or questions they are trying to generate for the future? Throughout the text, the authors use an effective technique of illustrating a particular concept—a segment of a clinical paper is featured as a numbered table/figure with text bubbles and arrows. The text bubbles are connected with arrows to specific sections of the table/figure where the topic of interest is used in the clinical research. In this way, a relevant example of the featured topic is shown from current clinical literature.

The second half of the book covers results analysis and the complexities of statistical significance. In this section, some advanced knowledge of mathematics and statistics is helpful as the clinical data have often been subjected to a computerized statistical analysis. The authors sum up the confusion of interpreting statistical analysis in the statement, "If you have trouble figuring out what it tells you, do not worry: no-one else can do any better than you" (p. 162). This refers to the use of odds ratios to explain results used primarily for the mathematical properties that are beyond the book's scope. Knowing this, the explanation of the p-value, a critical component of making results "significant" helps us understand just how complex statistical analysis really is, "How then do we decide what constitutes strong enough evidence against the hypothesis to enable us to reject it? The evidence we use is a probability, known as a *p-value*. The p-value is the probability of getting any particular outcome ...when the hypothesis is true" (p. 182). Overall, the second half of the book outlines different clinical scenarios, their results analysis, and the interpretation of their p-values and derivatives.

Impressive that Bowers, et al, was able to incorporate such an all-encompassing topic in 273 pages plus an eight-page reference section and a nine-page index. It is detailed enough for an experienced researcher yet realistic for an ambitious, educated layperson wanting to better understand clinical research. A must-have for the shelves of health-care professionals and health-care enthusiasts of all levels.

Julie Kinyoun

Julie Kinyoun is an on-call chemistry instructor at various community colleges in Southern California. An avid reader, she enjoys reviewing books that help her become a better educator.

Review of Three Textbooks on Technical Communication

By Lynne Cooke

INTRODUCTION

Every semester the instructors face a choice: which textbook will we use for our general technical communication course. It's a course we've probably all taught, yet how much time and thought do we give to the textbook we use? Are you on autopilot and choose the same textbook year after year?

As you'll see shortly, two of the three books reviewed here have 2021 editions and all have online supplemental material. Each comes with its set of strengths and is suitable for a particular audience. In full disclosure, I have used two of the textbooks, *The Essentials of Technical Communication* and *Technical Communication* for my upper division/graduate Fundamentals of Technical Communication course.

Are you ready to try a new textbook? Read on and see which is right for your technical communication class.

The Essentials of Technical Communication, 5ᵗʰ ed.

Elizabeth Tebeaux and Sam Dragga have authored an abbreviated take on genres and strategies for communicating technical and persuasive information. *The Essentials of Technical Communication* is just that and targets a lower-division audience unfamiliar with the topic.

If you're used to other lengthy technical communication textbooks, you'll find this one to be clear and concise. As one of the reviewers pointed out, the book "treats students like the busy adults that they are," which is a very apt description of this book's audience. At 424 pages, it is much more concise than competitors' books that can reach 700+ pages.

Some of this compactness comes from leaving out chapters contained in other textbooks. For example, there isn't a separate chapter on researching your subject, organizing your information, usability, or writing definitions. Instead, this information is incorporated throughout the book. For instance, the authors touch on usability when they discuss instructions; however, they do not go into any detail about the topic.

Tebeaux and Dragga continually emphasize the importance of audience as they note in an early textbook chapter: "Every decision you make in developing your documents should reflect your audience, their needs, and your purpose" (p. 15). In fact, the book includes an entire chapter on writing for your readers and producing audience-centered communication where the "you" approach to communicating is discussed.

The exercises are usually scenarios that involve students working either individually or in teams to solve a particular problem. Frequently, sample documents in need of revision are used for such exercises. There is nothing wrong with this, but I found that students quickly grew tired of these types of exercises and preferred other types of activities.

A typical chapter starts with an overview and objectives, then quickly moves on to the topic at hand. For example, in the chapter on proposal and progress reports, Tebeaux and Dragga provide a context for understanding the different technical communication document genres before delving into report writing. The chapters end with case studies, style checklists, and extensive exercises, the last of which seem a bit out of place in a book that markets itself as being the *essentials* of technical communication.

The textbook comes with an online component for students that includes internet resources, additional samples, and self-quizzes, along with PowerPoint slides that aren't particularly visually appealing. *The Essentials of Technical Communication* is a good compact book that packs a lot into its pages. It would be an excellent choice for any introductory technical communication course. The accessible format and language make it a nice fit for the classroom.

Review of Three Textbooks on Technical Communication

Technical Communication, 13th ed.

Editor's Note: This book was reviewed as an e-book. The page citations follow that of the American Psychology Association's 7th edition printing of the APA Publication Manual.

In this genre-based book, Mike Markel and Stuart Selber cover a lot of ground. From ethics in communication to document design to incident report writing, the topics are addressed in some detail, which is not surprising given the book's 768-page length. The 13th edition was recently published and is available for your fall book orders.

Each chapter contains technical tips, annotated examples, cases, guidelines, and writers' checklists that help ensure student comprehension. Each chapter ends with an exercise, appropriate for either in-class activities or take-home assignments. These are straightforward and directly address the material covered in the chapter.

Early on Markel and Selber break communication down into two types: (1) "communication that helps others learn about a subject, carry out a task, or make a decision," or (2) "communication that reinforces or changes attitudes and motivates readers to take action" (Purpose Related Factors section, paragraph 1). This distinction between communication types is important because it calls attention to both audience and purpose. Many textbooks fail to state the communication breakdown in such a direct manner.

One of the book's major strengths is its use of good examples in each chapter. They illustrate document types and contain extensive annotations which discuss the elements that make the document an exemplary piece of communication. These detailed annotations instruct students in understanding *how* a document achieves its purpose.

Two of the better chapters help students eliminate grammar, usage, and writing style errors. *Technical Communication* also devotes an entire chapter emphasizing how to arrange sentences and paragraphs while eliminating problems such as redundancy and wordiness. Several before and after examples are included and the exercises reinforce the covered material. An appendix with guidelines for editing and proofreading documents is a thoughtful addition. Put together, these guidelines comprehensively cover both the basics and nuances of writing, editing for clarity, and for using precise language.

Technical Communication is probably best for an upper-division class. Markel and Selber not only cover the genres of technical communication, but they also discuss evaluating and testing the usability of documents, designing online and print documentation, and creating graphics. Topics are covered at a more advanced level and examples are usually sophisticated pieces of writing.

Given its many features and its comprehensive coverage of all things technical communication, this is a solid choice as a textbook. The only real limiting factor is the cost, which at US$120.99 is steep. However, students have the option to rent the book for a lower cost or purchase an ebook version for US$59.99.

The Agile Communicator, 3rd ed.

When I first got my hands on a copy of the 3rd edition of *The Agile Communicator: Principles and Processes in Technical Communication,* I was thrilled to see that it covered all the ancillary topics I had been covering in my technical communication classes for years: visual communication, team processes, and web authoring.

Craig Baehr does a great job of addressing all facets of technical communication in this comprehensive, but not overly dense, book. In the first chapter, students are introduced to Agile Communication and waterfall approaches to documentation development. These are especially apt given that most businesses work under these models. Communicators who are agile "target the incoming changes, employ their research and knowledge management skills to understand its effects, and then adjust and flex their communication skills to encompass or work with it" (p. 9). Technical communicators who exhibit these skills are more likely to be successful in school and in the workplace.

As he does in the introduction, Baehr ties technical communication to workplace practices wherever possible. He mentions single-sourcing, information re-use, and boilerplates and discusses how these are used in business. For instance, on page 17, there is a handy chart showing content reuse levels and features (Table 1.1). This is a topic you don't often see discussed in textbooks even though it is common practice in the workplace.

The numerous exercises embedded within the chapters and set off in muted orange boxes are a particularly attractive feature of the book. Exercises are

located close to the related material, and assignments, which are lengthy enough to be completed in class as a team or at home as a solo project, are provided at the end of the chapters. Such versatility is typical of *The Agile Communicator.*

The book's online component is exceptionally well done. It includes case studies, models, and detailed PowerPoint slides that match the color scheme and theme of the edition. All the material is pertinent and makes for a first-rate supplement.

The book is extremely well laid out; the pages are inviting and easy to scan with color headings and subheadings, an ample amount of white space and, even though they are information-dense, they don't feel crowded. Each chapter features at least one flowchart, infographic or other visual to demonstrate a process or communicate an idea. Bulleted lists, a favorite of technical communicators, are frequently used throughout and scenarios are regularly presented to help students understand the complexities of real-world situations.

The Agile Communicator is a versatile textbook that provides plenty of exercises, examples, and scenarios for students to draw upon as they continue their journey into technical communication. This book is best for intermediate or advanced technical communication students.

REFERENCES

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ABOUT THE AUTHOR

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Review of Three Textbooks on Technical Communication

Table 1. Technical communication textbooks compared

	The Essentials of Technical Communication	**Technical Communication**	**The Agile Communicator**
Audience	Introductory	Intermediate/Advanced	Intermediate/Advanced
Major Strengths	• Covers the basic genres • Includes guidelines for writing for social media • Most affordable option • Compact and easy to access information within the pages and within the book • Easy to dive in and dive out of the book to get to specific material	• Colorful graphs, charts, and illustrations in most chapters • Color navigation tabs make it easy to locate chapters • Online material is well-organized and useful • Lots of annotated examples	• Discusses real world processes like waterfall and agile approaches to technical communication • Online supplementary materials are useful and relevant • Exercises are embedded in the chapters • Lots of color visuals
Major Weaknesses	• Online supplementary materials aren't particularly useful or helpful • A little too concise at times • The exercises are cumbersomely integrated into the chapters • Most examples don't have callouts or annotations	• Appears bulky at 732 pages • Paperback version is expensive • Some information is in giant text blocks; could be broken down into smaller paragraphs	• No writer's checklist at the end of chapters • Could use some additional examples • Needs additional annotations or callouts in examples
Comments	Compact and full of useful information. Best for introductory audiences. Good value.	A thorough examination of technical communication through genre analysis. Good for an intermediate audience.	Comprehensive and covers a wide range of topics. Versatile enough for an intermediate or advanced audience.
Rating (5-star scale)	****	****	*****
Cost (USD)	$59.99	$138.99	$89.99

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STC Online Courses	6
STC Summit Pre-Conference Courses (full day)	6
STC Summit Pre-Conference Courses (half day)	3
STC Annual Summit	8
Begin and complete a college-accredited course related to the Technical Communication field	8
Published articles that relate to any aspect of *Technical Communication* (2/article)	2
Published books publicly available on topics related to *Technical Communication* (5/book)	5
Presentations at conferences related to aspects of *Technical Communication* (2/presentation)	2
Total needed within 2 years post-certification date	12

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